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HISTORY OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Preliminary Report of the Committee on Society History

Chapter IX—*Concluded*

GROWING INFLUENCE OF THE SOCIETY

231 Prominent in the relations of the Society with the public may be mentioned the reports of the various committees appointed from time to time for the standardization of different portions of engineering work which had hitherto been conducted independently by various individuals and had lacked the systematic arrangement which could be given only by some such central body as The American Society of Mechanical Engineers.

232 Thus, the standard codes for testing steam engines and boliers, for standard duty-trials of pumping engines, and for tests of locomotives, provided methods which, however they may have been regarded in individual cases, placed all operations conducted under their methods upon a comparative basis. In like manner the standard system of pipe-flanges brought order out of chaos in a most important department of manufacturing work, and in this and similar instances the influence of the Society became extended beyond the limits of its immediate membership, and began to have its effect upon the general public, both as manufacturers and as consumers.

233 Another feature in the work of the Society which testified to its growing influence was the manner in which it entered upon the discussion of the economic side of mechanical engineering.

Under the direction of the Council the Committee on Society History has arranged to present the results of its investigations to the members of the Society. The Preliminary Report will appear in the Journal of the Society from time to time, enabling the matter to be open to comment during its completion. It is especially desired that any member who may be in the possession of facts or information bearing upon the various points as they are thus made public will communicate with the committee, in order that the final and completed report may have the advantage of the collaboration of the membership at large.

At the time when the Society was founded, it was the general opinion that the engineer or the mechanic had nothing whatever to do with the commercial or economic side of engineering work. Gradually it became apparent that the men who were competent to discuss the engineering features of important manufacturing enterprises were pre-eminently the ones who could undertake the development of the economic side of the same work. Thus arose the now firmly established plan which places in the hands of administrative engineers the organization and internal management of the works in which mechanical operations are conducted. From the original paper of Henry R. Towne, The Engineer as an Economist, through the epoch-making contribution of Frederick A. Halsey upon the premium system of wages, to the later discussions of F. W. Taylor, H. L. Gantt, and others, it has now become definitely settled that the mechanical engineer, of all men, is most competent to handle the economic side of engineering work; and in this transformation in public opinion and general practice The American Society of Mechanical Engineers must be accepted as the pioneer.

234 It has been said that the commercial development of the science of electrical engineering took place during the period between the foundation of The American Society of Mechanical Engineers in 1881 and the opening of the World's Fair at Chicago in 1893. As a matter of fact it is now being recognized that a large part of the work of the electrical engineer is included in that of the mechanical engineer, and reference to the Transactions of the Society during those memorable years will show the extent to which its members took part in the unfolding of the mechanical generation of electricity and its commercial and social applications. From the invention of the continuous-current electric generator by Gramme in 1868, through the work of Brush, Edison, Thomson, Houston, and their successors in the United States, and of Siemens, Ferranti, Hopkinson, and others in Europe, the mechanical engineer became the efficient associate of the electrical engineer. This is readily understood when it is considered that a large part of the generation of electricity includes the production of power and its delivery to the dynamo, while the construction of electrical apparatus calls for machine-shop work of a high order. It is not a matter for surprise, therefore, when we find in the Transactions of The American Society of Mechanical Engineers numerous papers relating to electrical matters, both as regards the production of the electrical current and its applications to the driving of machinery. The design and

equipment of large central stations has now become an important part of the work of the mechanical engineer, a work which had its inception largely among members of the Society, and to which much of their effort has since been directed.

235 In the tremendous growth of the iron and steel industry the work of members of the Society held an important part. It was by one of its founders, Alexander L. Holley, that the Bessemer process was introduced into the United States; a President of the Society, Robert W. Hunt, was one of the most energetic of its developers; another President, S. T. Wellman, was identified with the growth of the open-hearth process; while among other members who have done much to create the different types of the modern rolling-mill, there should be named two former Presidents, John Fritz and Charles H. Morgan.

236 In the development of the manufacture of iron and steel in the United States there is one name which stands pre-eminent as engineer, manufacturer, and philanthropist, that of Andrew Carnegie, a member of the Society for twenty years past, and always deeply interested in its work.

237 With the increase in general interest in the conservation of the natural resources of the country, it may be well to recall that almost from the origin of the Society its members have been quietly but most effectively reducing wastes, and seeking, as a part of their professional work, what has only recently been considered of public interest, the minimization of unnecessary losses in the "art of directing the great sources of power in Nature to the use and convenience of man."

238 In the very first volume of the Transactions of the Society there are four papers relating to the more economical use of steam, besides two discussing the reduction of friction losses, and two devoted to improvements in metallurgical processes.

239 A large part of the lifework of the late Professor Thurston was devoted to the furtherance of the economical use of steam, and hence a reduction of fuel consumption. One of the greatest contributions to the reduction of waste in the use of coal as fuel was due to the work of Eckley B. Coxe, in rendering practicable the utilization of small sizes of coal, and a résumé of his work in this field will be found in his presidential address of 1893.

240 The development of hydraulic power, and the possibilities of high efficiency by the scientific design of turbine wheels, have both occupied the attention of various members of the Society,

while improvements in machinery and methods of navigation are included in its work.

241 Another department of engineering work, in the progress of which many members of the Society have taken an effective part, is the mechanical handling of materials. The substitution of machinery for manual effort in this work has been very general during the period covered by the work of the Society, and the introduction of cableways, cantilevers, power-cranes of all kinds, industrial railways, belt-conveyors, and digging and dredging machinery of high power and great capacity, may be traced almost entirely to the activities of its members, among whom may be named two of its former Presidents, C. W. Hunt and James M. Dodge.

242 The progress of heat engines using other fluids than steam has been most rapid since the period now under consideration, but some excellent work was done during the earlier years of the existence of the Society. The efforts of Captain Ericsson, apart from his experiments with the direct utilization of the heat of the sun, occurred before the foundation of the Society. An excellent review of the entire subject appears in a paper entitled Substitutes of Steam, by former president George H. Babcock, in 1886, while the later progress of the internal-combustion motor, and the interest in its improvement by various members of the Society, led in subsequent years to the formation of a special section devoted to this question, a matter which will be more fully noticed hereafter.

243 Thus it is seen that the Society, during the first twelve years of its existence, from its foundation to the first succeeding international exhibition held in the United States, had progressed from a comparatively small organization, of interest mainly to its own members, to a great National institution, contributing, through the work of its members, to the acceleration of the progress of the world, and extending its influence over the fields of manufacture, industry, commerce, and economics, not only in the United States but in all parts of the civilized world.

ADDRESS BY REAR-ADMIRAL MELVILLE AND PRESENTATION OF PORTRAIT

The Society enjoyed the privilege, during the Convention in Washington, of hearing an address by Rear-Admiral George W. Melville on the subject of The Engineer in the United States Navy.

At the close of the address a portrait of Rear-Admiral Melville, painted by Sigismond de Ivanowski, was presented by friends of Rear-Admiral Melville to the National Gallery. Walter M. McFarland, a friend and former subordinate of Rear-Admiral Melville, made the presentation address. The portrait was received for the Nation by Dr. C. D. Walcott, Secretary of the Smithsonian Institution.

Abstracts of the addresses of Rear-Admiral Melville, Mr. McFarland and Dr. Walcott are published herewith.—The Editor.

THE ENGINEER IN THE U. S. NAVY

By Rear-Admiral Geo. W. Melville, Ret., Past-President Am. Soc. M. E.

Ten years ago my presidential address before the Society had almost the same theme as my remarks this evening. At that time the Personnel Law was passed, which amalgamated the engineer corps with the line or executive officers of the navy, with the understanding that thenceforth engineering was to be the function of these line-officers. In his report as Chairman of the Personnel Board, ex-President Roosevelt, then assistant secretary of the navy, said, "On the modern war vessel every officer has to be an engineer whether he wants to or not." It is well that these lines should be constantly in mind, for they set forth the only justification for the Personnel Law.

2 Remarks have been made to the effect that a line-officer charged with all these duties would be a hybrid or Jack-of-all-trades. It is to be noted, however, that our naval officers have to perform definite duties. The curriculum of the naval school can be planned to give them a thorough and specific training for the work they have to do. In this respect these young men have a decided advantage over the students of any of our great technical schools, who can receive instruction only in general principles because

they themselves rarely know the particular line of engineering work which they will follow. It is, in my judgment, just as ridiculous to speak of our modern line-officers, specially trained for the work they have to do, as Jacks-of-all-trades, as it would be to apply this designation to a blacksmith, a lawyer or a doctor.

3 I have not forgotten that I am talking of men who go to sea and that the line-officers are responsible for the handling of the ships; in other words, that seamanship is an essential element of the training. It must be remembered that the modern navy has entirely dispensed with sails and that it is a misnomer to call the modern man-of-warsman, a sailor. He is not a sailor, because there are no sails for him to handle. He is a seaman, because he goes to sea. Seamanship is an art, proficiency in which comes almost entirely from practice, so that officers who are given the other portions of the training in the classroom, laboratory and workshop, get the requisite proficiency in seamanship from the practical exercises during their career as midshipmen at the naval school, and in the handling of vessels after they graduate.

4 It is natural to inquire how the amalgamation has worked out in practice. On January 21 of this year, the chairman of the House Naval Committee quoted from the remarks of the officer who commanded the battleship fleet which cruised around the world, to the effect, "When I got to California, without any engineers, my fleet was in better condition than when it started." It would seem, however, to have agreed much better with the avowed intention of the Personnel Law if he had said, "Our cruise was a great success because every officer was an engineer."

5 The Chairman of the House Naval Committee further said, "It is the opinion of our naval officers, in command of our fleet and ships, that this consolidation has been a splendid thing for the navy, because it makes the man in command of the ship the master of the ship, a man who understands all the workings of the ship. Before, the command of the ship was in the hands of the engineer. We had to make a change in the curriculum of the Naval Academy whereby the officer of midshipmen there must acquire a knowledge of engineering, further adding to that the experience which he must obtain in the engine room as a watch officer. By reason of these facts, the entire ship is today under the command of an engineer officer, a man who understands all the duties of engineering and who is complete master of the ship."

6 I have been told by officers who have recently served on

board ship that one great benefit has resulted from the amalgamation: namely, that the idea just expressed in the above quotation is true; that the commanding officer is now the master of the entire ship. In my early days, few commanding officers felt any interest in the machinery beyond their demand that it should always be ready for service. If anything went wrong, they washed their hands of the responsibility, which was naturally upon the special body of engineers. They now feel the same keen interest in the machinery that they do in the guns or any other part of the ship, and the chief engineer of the ship (still so-called) is generally looked upon as the officer next in importance after the captain.

7 The part of the new régime about which I have felt misgivings is that thus far there has been no systematic effort to assure training and experience for every line-officer in connection with the motive power. Every young officer should be required to serve an apprenticeship in the engine and fire-rooms, just as he does on deck, but so far as I have been able to learn there has never been careful attention given to this point.

8 Having touched upon the general conditions of the executive side of engineering as affecting the operation and integrity of the machinery at sea, it is now pertinent to consider the prospects with regard to present and future designs. Thus far, this work has remained in the hands of officers specially trained. Unfortunately, the same condition is found here as mentioned in the previous division of the subject. An effort has been made to arouse the interest of some of the younger line-officers by a course of special training for this most important work after the present highly competent and experienced men have retired. There has, however, been no settled policy for this, and the attempt that was started was interrupted by the cruise of the Atlantic Fleet.

9 I am very glad indeed to bear testimony to the fact that the recent designs of the Bureau of Steam Engineering have been highly creditable in every way. In saying this, I feel a touch of personal pride for the reason that the men who have been doing this work were formerly my assistants and received most of their experience during my term of office. I am naturally pleased that the record which was made during my own term is being maintained.

10 When such praise as this can be given in simple truth, what can be thought of the official who plans to discredit the men who have made such a record, and destroy the autonomy of the Bureau by subordinating it to the Bureau charged with the design of hulls?

I believe you will agree that my service of a lifetime in the Navy and my record as the head of a great Bureau in the Department, the longest since the Civil War, entitles my opinion to some weight, and I want to register my earnest conviction that any such scheme of consolidation can only bring inefficiency, retrogression and waste.

11 There is still another side to engineering in the navy; namely, the work of the navy yards, which has been prominently before the public during the régime of the last Secretary of the Navy. Changes have been made abolishing the separate departments in the navy yards and consolidating their administration under one officer, whose work, while a vital element in the building of a ship, was certainly not the only important part and moreover was so different in its nature from the other departments which were absorbed, that it is obvious he could not be an expert on these other lines. To me it was so marvelous as to be almost beyond belief that in this age of specialization a movement so absolutely counter to the spirit of the age should take place in the name of economy and reform. If the great shipyards in civil life, or the great manufacturing establishments, or the dockyard administration of other countries, had been different from the methods employed in our navy yards, a change would at least have been indicated; if, in the other places to which I have referred, a system somewhat like the one which it has been attempted to introduce in our navy yards, was in vogue, there could be some understanding of the change: the facts are however, that in its essential features our navy yard administration was along the very lines which obtain in foreign dockyards, in the great shipyards at home and abroad, and in our great manufacturing establishments.

12 I am led to believe that the present Secretary is giving the matter very careful consideration with a view to undoing the tremendous harm brought about by his predecessor, and I trust he will be well-advised and will restore the yards to their former efficiency. It ought to be said, however, as a matter of record, that these changes were made without any consultation between the late Secretary and the officers most competent from long experience to know what was best. Indeed, by his own statement, the scheme was evolved from his own inner consciousness.

13 Our modern navy is essentially an engineering affair. The vessels themselves are the product of the engineer's brain, and their successful maintenance and utilization depend entirely on engineering skill. Ten years ago I said that the change which had been

made, absorbing the engineer corps into the line of the navy and making every officer an engineer, was a tremendous step forward, *provided* a sincere and earnest effort was made to carry out the scheme which was thus outlined.

14 From what I have said this evening, it will be clear that I am not as yet satisfied that this has been brought about. Undoubtedly the responsibility for the machinery of our vessels, guns, motive machinery, electrical machinery, torpedoes, etc., is upon the line-officer of the navy. He is charged with this duty by law. If the older officers of the navy had taken hold of this matter with enthusiasm, I believe that it would now have been settled and there would be no question as to the great success of the new officer, the line-officer of the twentieth century. I am not willing to believe (and indeed hardly willing to consider) the possibility that naval officers will neglect any duty with which they are charged, and I still hope that the scheme will be worked out to a great success.

15 Not much is ordinarily said about the machinists who are doing good work on board our vessels. They look after the routine work of repair and adjustment on board ship, but they are without the scientific training which is required for engineers who are really qualified for the duties comprehended by that title. If the line-officers of the navy do not maintain engineering efficiency, it will then, as the organization now stands, fall upon these machinists to perform the work of the engineers. In other words, in an organization whose efficiency is absolutely dependent upon the skill of engineers the men relied upon for such work would be relegated to a position of inferiority so low that they are hardly counted. This is utterly un-American and can only be matched by absolute monarchies or countries as unprogressive in the mechanic arts as Spain. The speedy destruction of her navy in the war of 1898 was due even more to her utter incompetence in engineering than in gunnery. It is inconceivable that self-respecting men in a free country like ours will attempt to perform work of such vital importance without adequate recognition in the way of rank and position.

16 I will not permit myself to believe that we shall have to consider this as a practical question because I cannot conceive that naval officers would fail in duty, but I have felt that both sides of the question, so vital to our naval efficiency, should be presented.

17 During my entire career in the navy, it was my constant endeavor to show by my work the importance of the engineer and to encourage that spirit in my subordinates. I trust I will not be

accused of vanity if I say that I believe my record as engineer-in-chief added a little to the reputation of engineering. My active work in the navy is done, but so long as I live my interest will never slacken and my voice will always be raised to encourage efficiency in every branch of the service.

PRESENTATION OF PORTRAIT

ADDRESS BY WALTER M. McFARLAND IN PRESENTING A PORTRAIT OF REAR-ADMIRAL MELVILLE TO THE NATIONAL GALLERY

The honor of being invited to pay a tribute to my dear old Chief, Admiral Melville, is one which I appreciate highly, as well as the allied one of acting as spokesman for the donors of the splendid portrait which is to be presented to the National Gallery this evening. I admire the Admiral as the fine flower of a splendid type of manhood, and his kindness to me for many years has been so like a father's that with a son's affection I rejoice at this splendid testimonial to his personality and his work.

2 Too often the pathway to greatness and fame is marked by the wreckage of competitors, and even friends, who have been ruthlessly thrust aside in the egoism of selfish ambition. Then, there may be a grudging admission of ability, but there is no love, no true admiration. When, on the other hand, the hero has always been the helper and friend of his companions, when he has cheerfully acknowledged their aid to his success, we have such greatness as we are celebrating tonight. Then, every member of the profession feels that the fame of the leader is reflected on the whole body, and they love the man while they rejoice in his reputation.

3 George Wallace Melville is such a man. He has been one of the famous men of engineering so long that we find it hard to remember a time when his name was not synonymous, as it is now, with all that represents progress and achievement in our profession.

4 It is a matter of delight to all of us who love him that the artist, in the picture which is to be presented to the National Gallery this evening, has faithfully depicted the chief characteristics which have made him great. These are, in my judgment, indomitable courage and unbending honesty. It is possible for a man to have great mental ability and yet fail of true greatness if he lack these essentials.

5 You all know Melville's Arctic record, which first brought him an international reputation; there he displayed a heroic courage which has never been surpassed, and for which Congress advanced him a grade in the Navy. This, however, was only a repetition of other instances of absolute fearlessness, beginning with his earliest days in the Service. When he became Engineer-in-Chief, the same courage, but rather on the moral than the physical side, was shown. Beginning with his first annual report, he spoke out fearlessly, setting forth the truth as he saw it and striving always for advancement and efficiency. Complaint was made to President Cleveland of the plain speech in this first report, but that strong man read it himself and said, "We want more such men."

6 His professional courage is also remarkable, and along with this is a faculty, which I believe is a characteristic of all great men, that having made his decision he does not worry about the result. Able men of minor rank are always fearful that something may go wrong and their reputation be injured. The really big man does not believe himself infallible. He knows that all men who *do* things will make some mistakes, and he is strong enough not to dread them. A notable instance of this kind in Melville's career was his use of triple screws for the Columbia and Minneapolis. I saw letters from some of his friends, for whose professional opinion he had the highest regard, urging him not to make the experiment. but he had studied the problem carefully, was satisfied with the correctness of the solution, and persevered. The result was perhaps the greatest triumph of his professional career.

7 His ability as an executive was of a very high order. The feature of deciding a case and then refraining from worry is an evidence. He had a rare talent for choosing able assistants, and having proved them he left in their hands all the detail work, thereby giving himself time for careful study of the larger problems. The effect of this was very marked in stimulating the entire staff to the highest efficiency and zeal. I have known them all personally, and every man counted it a pleasure to work, without regard to hours, for the credit of the "Chief" and the glory of the Service.

8 With respect to his professional work, it is notable that his career as Engineer-in-Chief of the Navy, from 1887 to 1903, is the longest on record. It covers the building of the "new navy," and the Spanish war. During this time he was responsible for new designs of machinery for about 120 vessels, among which were 24 battleships

and 41 armored vessels. Best of all, there were no "lame ducks," and no failures.

9 I will mention briefly some details of his more important work. He was the first to use water-tube boilers in large war vessels and to determine the actual coal consumption by trials. He was also the first to use the method of determining trial-speeds, known as the "standardized screw," which is the simplest, most accurate and inexpensive, and fairest to the contractor as well as to the government.

10 It is to him also that we owe our first high-speed battleship. When in 1898 the proposals for the Maine, Missouri and Ohio were being prepared, he stood alone in his demand for 18-knot ships. If he had not persisted, we should have been three years longer behind the other navies of the world in battleship speed.

11 It is very interesting to note also that only a little after this he proposed an "all-gun one-caliber ship:" in other words, what is now called the "Dreadnought" type. Before I left the Service, I had often heard him talk of this big ship with ten twelve-inch or twelve ten-inch rifles and nineteen or twenty knots speed; and about 1899 he submitted a sketch plan of the battery of such a ship to the Board on Construction. Possibly the same influence which almost prevented the eighteen-knot battleships prevented consideration of this more advanced type. At all events Melville was in advance of the general naval mind, and our country lost the credit for the introduction of this revolutionary improvement which it might have had several years before the "Dreadnought" was disclosed.

12 During the war with Spain he brought out the repair ship and the distilling ship. The idea of the former was not new, but the Vulcan was by far the most complete vessel of the kind equipped up to that time. The latter furnished fresh feed-water to the boilers and enabled a vessel with a storage bunker capacity of 3000 tons to supply 60,000 tons of water.

13 A clever piece of work at this time was the fitting of new boilers to some of the old Civil War Monitors to enable them to be used for harbor defense. For years Melville had advised the Navy Department that new boilers must be supplied before these vessels could be used. When the destruction of the Maine made the outbreak of hostilities seem probable, the makers of water-tube boilers submitted estimates of time and cost for the work. Boilers were promised in 30 days, but it was necessary to use the standard land type. As these vessels were not to go to sea, however, this was

satisfactory. The wornout boilers were cut up and passed out through the smokepipe (because the armored deck could not be taken up; the new boilers were passed down the smokepipe in sections and erected on board; finally each of the boats was given a steam trial, which was entirely successful.

14 A great deal of experimental work was done under his direction, all of which is published in his annual reports. The last of such experiments was a series of tests of oil-fuel, probably the most comprehensive ever made.

15 My brief sketch of this famous man would be incomplete if I failed to speak of his personality. The lion-like head and the frank speech have led some to say that he is one of the old "Vikings," spared to us a thousand years after the others have gone; but if this leads any to think that he is harsh and cold, there could be no greater mistake. Like all strong natures, he is pronounced in his feelings, but he is a man of warm affection, and when he has once taken you into his heart, you are sure of an abiding-place there as long as you are worthy. It is often said that no man is great to his intimates, but I have been with him, day by day, for years; have seen him under all conditions; and my admiration and love for him have simply increased as the years go by. I have no ambition to be a Boswell and I have not kept notes of his doings; but I have seen the daily workings of a great, kind heart, tender for the humble yet fearless toward the great; and I can truly say that I count it a privilege and an inspiration to have been a trusted friend and helper of this noble man, who has exemplified the highest type of manhood and added new luster to the profession of engineering.

ACCEPTANCE BY DR. C. D. WALCOTT

It gives me pleasure, speaking for the Smithsonian Institution as the custodian of the National Collection of Art, to accept from you for the people of this country this fine portrait of Rear-Admiral George Wallace Melville, to be exhibited in the gallery of portraits of Americans who have achieved eminence in their life work.

2 Among the men who have rendered distinguished service to their country in literature, science, or art, in war or in peace, in professional or civil life—few have won such well-merited distinction in so many lines of duty as Admiral Melville. He stands high in the regard of the Nation as a naval hero, as an engineer of exceptional ability, and as a wise and resourceful administrator and

advisor. It is only to be regretted that, under the operation of law governing retirement, Admiral Melville was obliged to retire from active duty in 1903, but it is to be hoped that the country which he has so efficiently and actively served may long be permitted to enjoy the benefits of his counsel.

3 The portrait of Admiral Melville is a most appropriate addition to this National collection and it is peculiarly fitting that his services should be emphasized in this happy manner by a Society which embraces so distinguished an array of men in the engineering profession, a Society that for nearly thirty years has exercised a powerful influence toward unity of interest and harmony of purpose in the broad field of American engineering.

DISCUSSION ON PAPERS PREVIOUS TO SPRING MEETING

THE PHYSICAL PROPERTIES OF CARBONIC ACID AND THE CONDITIONS OF ITS ECONOMIC STORAGE FOR TRANSPORTATION

By Prof. R. T. Stewart, Published in The Journal for November

ABSTRACT OF PAPER

This paper gives the results of recent investigations into the physical properties of carbonic acid, necessary in investigating the strength and safety of existing carbonic acid cylinders and in the design of new cylinders on a safe and economic basis.

The results of this investigation have made it possible for the first time to state the conditions under which the weight of the containing cylinder will be a minimum for the customary conditions of storage and transportation of carbonic acid.

The paper is accompanied by very complete tables, covering, it is believed, a range of conditions sufficient for the solution of any problems apt to arise regarding the physical properties of carbonic acid in connection with its storage and transportation. Of these, Table 4 will be found most useful for the investigation of the strength and safety of existing cylinders, and Table 5 for the designing of new cylinders of minimum weight of steel in the shell per unit weight of acid contained.

There is also an addendum showing the necessity of a further investigation of the carbonic acid cylinder problem, especially as regards the most suitable steel for cylinder construction and the safety of cylinders now in use.

DISCUSSION

Mr. John C. Minor, Jr.[1] Professor Stewart has taken up with admirable thoroughness a most important subject hitherto practically neglected by technical authorities. The necessity of the data which

[1] John C. Minor, Jr., Manager N. Y. Carbonic Acid Gas Co., Saratoga Springs, N. Y.

he has so fully worked out, in the proper and safe design of cylinders, cannot be questioned.

2 Much credit must be given to the British Commission, which in 1896 was the first to investigate the safety of high-pressure gas-containers; they confined themselves, however, to the consideration of accidents and to drawing up specifications for standard containers, and suggesting regulations for the future conduct of the business. It does appear, as Professor Stewart says, that they were in some respects supplied with incorrect data, but their errors were in the direction of safety, and measured by results, the report of that Commission marked a tremendous advance. Its suggestions never became law, but were adopted in their entirety by the gas manufacturers, with the result, as I am informed, that there have since then been no explosions of cylinders whatever in Great Britain. Professor Stewart's investigation will, I trust, lead to an equally beneficial outcome in this country.

3 While the trade in compressed and liquefied gases has not in this country reached the proportions to which it has attained abroad, it is nevertheless of considerable volume. It is here largely confined at present to carbonic acid, with but a small production of other gases, although the oxy-acetylene welding process is rapidly bringing high-pressure oxygen into use. With Buffalo and Pittsburgh as western limits, and Philadelphia on the south, there are probably 500,000 cylinders a year of all sizes circulating in the East. This industry has been going on ever since 1888, and with remarkable freedom from accident.

4 With present practice it takes 70 lb. of steel to carry 20 lb. of gas, and high rates on the railroads make the freight bill perhaps one-fourth of the whole expense. Hence temptation manifests itself in two ways: the manufacturer wants to make his tubes as light as possible in order to obtain the business, and may be prodded, if unwilling, by the buyer, who sees the possibility of reducing freight expense. The gas-producer, on his side, for every pound of gas put in the cylinder over a safe load, gets increased work and reduction of expense. I believe that the author has called a halt on all this in time to prevent the situation arising here, as in Germany, where competition carried the weight of cylinders down until the record of accidents brought governmental interference.

5 In his determination of the proportionate space occupied in a cylinder by gaseous and liquid CO_2 the author reaches conclusions whose accuracy will not, I think, be questioned. These are shown

in Table 5, which well illustrates the value of this investigation, as the most recent contribution on this subject (by Lange in the Zeitschrift fur Angewandte Chemie, 1903, p. 511) gives figures at wide variance from those of Professor Stewart.

6 The author brings out the fact that with a filling of 62 per cent, i.e., with 56 lb. of CO_2 in a large cylinder, the entire cylinder volume is filled with liquid, and all supernatant vapor condensed, at temperatures between 84 and 86 deg. In England, where the regulations permit 66 lb. of CO_2 in this size of cylinder, this condition arises at temperatures above 70 deg.

7 Assuming the slight solubility of air in liquid CO_2 indicated by the author, an assumption which my own experiments do not yet tend to prove, what becomes of the air originally present in a tube thus completely full of liquid CO_2? If it is not dissolved, would the suggested allowance of 60 lb. additional pressure for each 1 per cent of air be proper in determining the actual pressure to be expected under these conditions?

8 One point in connection with the economics of design is brought out strongly if we compare our American cylinders with those of England, where a filling of 66 lb. is permitted in the size cylinder which manufacturers here recommend for 50 lb. They use a low carbon steel and put in more metal, 120 lb. I think, to our 100 lb. They thus incur a proportionately lower freight per pound of gas, and have the still greater advantage in increased storage capacity. Not much CO_2 is sold in winter, at which time the cylinders serve as storage reservoirs rather than containers for transportation. Any slight additional cost would be welcomed, therefore, which without changing the conditions of safely would insure an increase of storage capacity of 30 per cent.

9 I probably do not interpret Fig. 9 correctly, but on applying it to the two types of cylinders in common use, holding respectively 20 and 50 lb. of CO_2, the following results appear with reference to the most economic condition of storage; assuming a maximum temperature of 120 deg. the weight of the shell should be 3.05 times the weight of the contained acid, and hence the weight of a cylinder for 20 lb. of CO_2 should be 62 lb. In practice it averages 70 lb. But cylinders to hold 50 lb. of CO_2, according to Fig. 9, should take 155 lb. of metal under the same conditions, whereas these cylinders in use average 100 lb. I shall be glad to admit what I feel sure is my error, if it will aid me in interpreting one of the most important results of the investigation.

10 It is clearly brought out that protection against accident is not afforded by hydraulic test alone, on which complete reliance has hitherto been placed; provision must be made for tests of the character of the metal and its ability to stand usage. The new German regulations apply these only to new cylinders, and not to those in use, which seems essentially wrong.

11 The metal in use abroad for cylinders is so different that we cannot adopt the same regulations for testing, and much remains to be done along the lines here pointed out to provide for the safety of these containers. The question arises whether periodic renewals of the hydraulic test should not be made on all cylinders, and if so, what pressure should be set for it. Should not a certain number out of every thousand old cylinders be also subjected to an examination of their ductility, and what figure should here obtain?

12 I believe that the result of this investigation will be not only to provide data for standard specifications of new cylinders, but to induce on the part of producers of CO_2 a careful examination of all cylinders now in use. I have been assured of the concurrence of several companies in this effort to weed out dangerous tubes, and by periodic inspection and test to maintain conditions of safety, and we shall be glad to render all possible assistance, by the contribution of tubes for examination and test, etc., in any further investigation.

13 The great freedom from accident of the CO_2 industry in this country has been due mainly to our good fortune in having tubes furnished us that were better than we had reason to expect, and which have stood, almost without exception, hard usage for years. To what we have gained from good luck we may now hope to add the advantages resulting from the application of common sense along the trail blazed by the author.

Mr. Herman E. Stürcke.[1] In a general way, the scientific part of this paper may be accepted as substantially correct. The writer would like to call attention, however, to the figures of Thiele and Deckert (Zeitschr. für angew. Chemie, 1907), showing that 1 per cent of foreign gases causes a pressure increase of about 75 lb., as against *60 lb.*, as stated. The author may also learn there of a possible error in some of his experiments. His method of determination of foreign gases at a temperature above the critical point materially facilitates the solution of the problem of the influence of foreign gases.

[1] Herman E. Stürcke, General Manager, Crescent Chemical Manufacturing Company, Brooklyn, N. Y.

2 As a manufacturer of carbonic acid, the writer welcomes the author's investigation, but does not agree with his conclusions and recommendations. It is not clear to him why the author should come to his conclusions only now, after having the data for over four years. Knowing my fellow-beings to be in imminent danger, and in ignorance thereof, I am either very careless in fulfilling my duty, if I postpone the warning cry, or else the danger is more imaginary than real.

3 On May 26, 1904, at a meeting of carbonic acid manufacturers the author stated that he had made for a cylinder manufacturer a very thorough inquiry into the physical properties of CO_2 as bearing upon the questions of storage and transportation, and that, while the investigations had not yet been completed and formally reported to the cylinder manufacturer, he had been granted the privilege of submitting the tables and charts then ready. The author at this time stated his belief that the standard cylinders of that company were entirely safe, with the most economic filling at 62 per cent, at a temperature not to exceed 110 deg. fahr., and at a maximum of 3 per cent of air present.

4 The author also gave as the factors of safety, for seamless cylinders

at 110 deg. fahr., for 55 per cent, 4.1; for 66 per cent, 3.4

at 130 deg. fahr., for 55 per cent, 3.25; for 66 per cent, 2.6

for lapwelded cylinders

at 110 deg. fahr., for 55 per cent, 3.7; for 66 per cent, 3.23

at 130 deg. fahr., for 55 per cent, 2.9; for 66 per cent, 2.48

and further stated: Seamless cylinders generally burst between 5100 and 5900 lb. pressure; lapwelded cylinders between 4900 and 5500. The manufacturers present certainly carried away the conviction that the manufacturer who had commissioned the author with the investigation was supplying safe cylinders. He should enlighten us as to why he now differs from this opinion.

5 In 1904 the author knew of only five explosions of CO_2 cylinders. The writer knows of only two explosions in the United States since that date and both were caused by overloading and undue exposure to heat or excessive shock. During the 24 years of the existence of the CO_2 industry in the United States, seven or possibly eight cylinders have exploded, with a loss of two lives: on an average one explosion in three years, or about one cylinder in 5,000,000 cylinders filled. This estimate does not, of course, include explosions caused by fire, or explosions of soda-water tanks and car-

bonating apparatus, frequently reported in the press as explosions of carbonic acid cylinders.

6 This very small proportion of explosions is likely to decrease still further on account of the gradual adoption of safety devices, and the greater care which manufacturers take to prevent overloading. The seamless cylinders, now mostly used, have a water-capacity of 88 to 92 lb., and are seldom filled with more than 50 lb. or 51 lb. of carbonic acid, giving a filling of about 55 or 56 per cent, or 10 per cent less than the 62 per cent claimed by the author as most economic, with a pressure reduction of 10 per cent and more at the danger point.

7 From personal observation and experience I know the English cylinders, of which the author speaks so highly, to be clumsy, unhandy and thick. They are, of course, safe, but their good record is partly due to their low pressure safety device. The carbonic acid industry is not so prosperous that it could carry the heavy burden of English cylinders and American customers would prefer their old system of marble dust and acid to the use of English drums.

8 As for the light German cylinders, one of the oldest American companies, which uses these exclusively, and has around 30,000 in constant service, has not lost one cylinder in twenty-two years by explosion in service or in transit. Used with reasonable care German cylinders are not as black as sometimes painted.

9 In Germany the regulations permit loading to 75 per cent water capacity. At 120 deg. fahr., a loading of 55 per cent gives a pressure of 1630 lb., 75 per cent gives a pressure of 2450 lb. If this were reduced to 55 or 60 per cent, few explosions would be heard of, especially if safety devices should become more general. Of the eleven explosions of CO_2 cylinders in transit or in service between 1894 and 1902, in Europe, three only were caused by poor material (in 1896 and 1897); the other eight by overloading and exposure to the hot sun, hot water, a red-hot stove, etc. Explosions of German cylinders have occurred since 1902, and will continue, official testing notwithstanding. Why then impose upon the American CO_2 industry a burden which does not protect, and causes endless expense and annoyance? The disastrous consequences of a compulsory change of cylinders have been experienced in Germany. When the light steel cylinders came into use there, five companies could not survive the change.

10 Opinion has been expressed to the writer by a competent authority to the effect: "We believe as you do that with the 500,000

American-made drums in the United States, the explosions that have taken place have been infinitesimally few and we do not know of an instance of an explosion of cylinders such as you use, except on account of overloading."

11 If the author intends to secure for all interested more protection against explosion he can attain this end by a practical scheme to avoid overloading and by developing safety devices.

Mr. Graham Clarke.[1] Our company has been engaged in the gas business for 25 years. We have about fifty thousand cylinders in which to store and transport carbonic acid gas, nitrous oxid and oxygen; and we have never had a cylinder explode. Our cylinders are filled on an average four times a year and are shipped to all parts of the country. We have always bought our drums from reputable makers, believing it would be to their interest to safeguard their business by giving us the most suitable material and the best workmanship. While the cylinders come to us tested, we give them an additional hydraulic test in our factory.

2 While Professor Stewart thinks this test is not of great importance, we feel, from our past experience, that it has served us well. We plan to re-test our cylinders as nearly as possible at intervals of five years. We have apparatus for determining permanent stretch and test a certain number for this to see if there is any deterioration of the cylinders with age. If a cylinder shows a permanent stretch of any extent we destroy it. When cylinders of a make unknown to us come into our factory for refilling, we have them tested.

3 In filling drums it is very important to see that they are not overloaded. Our drums are all weighed at the filling-stand, and tags giving the gross, tare and net weights are put on them. The weight of the empty cylinder is stamped on the side of the metal valve. These drums are then put in stock, and before being shipped they are reweighed. This double check serves as an extra precaution to make sure that the drums are not sent out overcharged.

4 From our long experience we believe the drums now in service are of sufficient strength, if properly tested, and not over-loaded, and while we would welcome any rules, yet we believe the manufacturers of gases, who know the practical side of business, should be consulted in regard to them.

[1] Mr. Graham Clarke, General Manager, Lennox Chemical Co., Cleveland, O.

Mr. L. H. Thullen. The manufacturers of carbonic acid in this country have made numerous experiments to ascertain the pressure-rise with increase of temperature and with different degrees of filling. These figures were made for their own use, and have not been published to any extent. They have made also extensive tests of cylinders for bursting-pressure and ductility, and by chemical analysis.

2 Cylinders in general use here will contain 20 and 50 lb. of carbonic acid, and are generally 5 in. and 8 in. respectively in inside diameter, and 50 in. long. The 5-in cylinders are generally made of ¼-in soft steel, having a tensile strength of 60,000 lb. per square inch. Some of the 8-in. cylinders are made of high grade steel of 95,000 lb. tensile strength, and have a ¼-in. wall.

3 Some of the cylinders are made in this country and a large number imported, some of high-grade steel coming from Germany. Cylinders are imported not necessarily on account of their superior quality, but on account of the difference in price between the domestic and imported article. The high price of domestic cylinders is due to the same cause that makes steel rails sell at $28 a ton in this country, while sold abroad by the same company, freight paid, for $22 a ton.

4 There are in use here by manufacturers of carbonic acid about 600,000 cylinders of different sizes. These cylinders are charged about four times a year, making a total of 2,400,000 to 3,000,000 cylinders charged a year.

5 In the last 20 years there have been, from different causes, about half a dozen explosions of carbonic acid cylinders. Practically all these explosions were due to gross carelessness in handling and storing the cylinders, the majority being caused by the cylinders being subjected to a high temperature. Conditions that result from this latter cause may readily be seen by referring to Professor Stewart's table of pressures for different temperatures.

6 On this basis there has been about one explosion to 5,000,000 filled cylinders in the last 20 years. It is safe to assume that a larger ratio of loss of life has resulted from the overturning of teakettles.

7 The author leaves us under the impression that the proper filling for carbonic acid cylinders is about 60 to 62 per cent of their water capacity. I am of the opinion that a filling of about 55 per cent would be more correct. This would make a pressure on the walls of the cylinder of about 2000 lb. per square inch; at a temperature of 130 deg. fahr., the gas containing about 3 per cent air, which is the maximum contained in commercial carbonic acid. A tempera-

ture of 130 deg. fahr. is about the temperature that a metal object lying out in the sun would attain when the temperature in the shade is 90 deg., and as these cylinders are apt to be in the sun at some time, I think 130 deg. fahr. should be the maximum.

8 It is not logical to build the cylinder walls of sufficient thickness, or have the factor of safety sufficiently large, to meet a rise in the temperature under extraordinary conditions, such as fire, or for excessive filling. Such conditions should be cared for by means of a safety valve or safety device of some form. The means generally used is a soft metal disk, that ruptures, and exhausts the cylinder, when the pressure reaches a predetermined point below the yielding point of the metal and well below the rupturing point. This has been found to give ample protection, as demonstrated by the small number of explosions; and there is no more reason for designing a carbonic acid cylinder to meet all pressure rises than for designing a boiler to meet all increases of pressure with no safety valve.

9 I am of the opinion that the safety device on the carbonic acid cylinders should be so designed that an increase in temperature would make a decrease in the releasing point of the valve. Such a device could be in the form of a disk composed of a substance that had a yielding point at a comparatively low temperature. There are a number of substances that would fill this requirement.

10 With a safety device to release the pressure at a point corresponding to a temperature a little above the assumed maximum, it would be safe to design the cylinders with a moderate factor of safety; 3.3 under these conditions would be ample. This would correspond to a fiber strain of 20,000 for steel having a minimum tensile strength of 65,000 lb. per square inch, and would be well below the yielding point of steel having a tensile strength of 35,000 lb. Soft steel for cylinders should have a tensile strength of not less than 65,000 lb. per square inch, a yielding point of not less than 35,000 and an elongation of not less than 25 per cent in 8 in.

11 As a 5-in. cylinder generally contains but 20 lb. of carbonic acid, and an 8-in. cylinder 50 lb., valued at 4 cents per pound, or 80 cents and $2 respectively, and the empty cylinders when made of soft steel weigh 70 and 100 lb. respectively, the freight rate being about 35 cents per hundred, it is apparent that a great effort should be made to decrease the weight of the empty cylinders. In fact, good engineering in cylinder design requires steel of the highest tensile strength consistent with reasonable ductility, and steel that will not deteriorate in physical quality while undergoing manufacture

into cylinders. At the present stage of the steel industry, steel of a tensile strength as high as 100,000 lb. per square inch would be perfectly feasible for use.

12 The following would be good specifications for such steel:

Phosphorus (basic)	not to exceed	0.03	per cent
Phosphorus (acid)	" " "	0.05	" "
Sulphur	" " "	0.03	" "
Carbon	" " "	0.60	" "

Tensile strength not less than 100,000 or more than 115,000.
Elastic limit not less than 55,000 or more than 65,000.
Elongation not less than 12 per cent in 8 in.

This would make a cylinder of reasonable weight, which with a calculated maximum temperature of 130 deg. and the proper pressure-releasing device would be perfectly safe with a safety factor of 3.3 or a fiber strain of 30,000 lb. per square inch.

13 With a maximum calculated pressure of 2,000 lb. per square inch, the thickness of the 5-in. and 8-in. cylinder walls would then be 0.16 in. and 0.26 in. respectively. Cylinders should not be tested to the yielding point; in fact, I would recommend a hydrostatic test at not to exceed 80 per cent of the yielding point. This test should be made only to detect any leak, imperfection of manufacture or thin spot in the cylinder.

14 I understand that in some countries it is customary to anneal the cylinders periodically; my opinion is that this would be detrimental to the cylinders and add an unnecessary burden to the manufacture of carbonic acid gas. Considering the small percentage of accidents in this country during the 24 years of the manufacture and transportation of carbonic acid gas, I see no reason for laying great stress on further investigation, unless it be along the line of making the cylinders lighter, and using high-grade steel, thus reducing the cost of shipment of this and other compressed gases.

Mr. E. D. Meier. I want to speak simply to the question of the composition of the steel in the cylinders. I do not think any comparison of the three statements in the paper is possible, for the simple reason that they do not state the amount of phosphorus or sulphur in the steel. I speak from the standpoint of the boiler manufacturer: the problem is similar to ours except that we have to do mainly with cylinders under conditions of great heat, whereas with the carbonic acid cylinder you are dealing with cold. We know that phosphorus makes steel what is called by the mill men "cold short," that

is, more likely to break or crack when cold. Sulphur makes steel "red short," that is, likely to crack when in a heated condition. I believe that the difference between English and German cylinders may be explained by the percentage of either metalloid. Then again the German cylinders of 95,000-lb. tensile strength contain a slight percentage of nickel or vanadium, which would put them in a different class.

2 I take issue with Mr. Thullen with regard to the percentage of phosphorus. Phosphorus is bad for any steel where you have much tensile stress, and there is no reason, except possibly a commercial one, for permitting more phosphorus in acid steel than in basic steel, simply because it is easier to get it out of the basic steel. The danger of an excess of phosphorus is very great. I have investigated a number of ruptures of plates that occurred after flanging, and in every single instance, taking the chemical analysis from borings near the point of rupture, it was found that the rupture was due to high phosphorus.

3 A very searching investigation was conducted by Charles L. Huston a few years ago in regard to the segregation of the metalloids. He found that in the ingot the metalloids segregated into a series of parabaloids, with the wide end at the top of the ingot, and therefore in order to make good boiler steel more must be discarded from the top of the ingot than formerly; and I do not think any specification for a vessel to contain liquid or gas under pressure is sufficient unless it gives also the percentage of phosphorus and sulphur.

Mr. Sanford A. Moss. I have been interested in comparing the pressures of saturated vapor given by Professor Stewart with those deduced from other experiments. There are some slight differences, but on the whole, the agreement is close.

2 In an investigation of experiments on vapor pressure of solid CO_2 and liquid CO_2 below 0 deg. cent.,[1] I found that the following equation gave vapor pressure of liquid CO_2

$$\text{Log}_{10}\, p = 45.8372 - 1 \div \left(0.025975 - \frac{0.4992}{T}\right) \qquad (2)$$

Here p is vapor pressure in mm. Hg (760 mm. = 1 atm.), and T is absolute centigrade temperature.

3 This equation fitted observations with remarkable accuracy from pressure of about three atmospheres for super-cooled liquid

[1] Physical Review, vol. 26, No. 6, June 1908, p. 439.

at -65 deg. to pressure of about 20 atmospheres at − 20 deg. cent. The critical point is also given by the equation.

4 I find that the vapor pressures given by Professor Stewart agree with values computed from this equation in the vicinity of the critical pressure. As the pressure becomes lower, there begins to be a slight divergence, and at 0 deg. cent. there is a difference of about 2 per cent. Below 0 deg. cent., the equation agrees almost exactly with the experiments of a number of observers.

TABLE 1 VALUE OF VAPOR PRESSURE OF CO_2 IN ATMOSPHERES (760 mm. Hg)

Degrees Cent.	Computed Value	Amagat's Value
0	34.9	34.3
10	45.0	44.2
20	56.9	56.3
31	72.4	72.3

5 Values given by various observers for the critical point agree very closely with those of Amagat. Lowest reputable value is 31 deg.

Prof. Wm. Kent. Referring to Professor Stewart's statement in Par. 134, "Any scheme that necessarily overstresses the good cylinders in order to eliminate the occasional defective ones is highly improper," will a proof test of 1.5 times the working load overstress the cylinders? Suppose the yield point to be 37,000 lb. and the maximum working fibre stress 20,000 lb., what harm can be done by a proof test that stresses the metal to 30,000 lb. This would cause an elongation, elastic, not permanent, of only 0.1 per cent. And even if the elastic limit were passed and the total elongation was 1 per cent, what harm could be done, since the material has a ductility of over 20 per cent?

The Author. The aim of this paper, exclusive of the Addendum, is to furnish data for the solution of problems relating to the safety and economic design of carbonic acid containers, in so far as the physical properties of the acid itself are concerned. The data given are the results of very thorough researches on the physical properties of both chemically pure and commercial carbonic acid; and it is believed are adequate for the solution of all problems that are apt to arise in this connection.

2 The aim of the Addendum is to point out the fact that the

experimental data given in the paper cover only one phase of the cylinder problem, namely, from the standpoint of the physical properties of the carbonic acid itself; while other phases of the commercial problem, such as suitability of materials to cylinder construction, deterioration while in service, periodic heat treatment and tests, apparently have not yet been adequately investigated.

3 The author refrains from making a lengthy closure to this paper and discussions for the following reasons: First, the few questions raised on the paper proper will be clearly answered by a careful perusal of the paper itself. Second, the discussion of the Addendum relates chiefly to matters which apparently have not as yet been sufficiently investigated to enable anyone to arrive at definite conclusions. The author believes, after listening to the discussion of the Addendum, that there is still a necessity for a further investigation of the compressed-gas container problem.

FUEL ECONOMY TESTS

By C. R. Weymouth, Published in The Journal for Mid-November

Prof. W. B. Gregory. The economy shown in these tests is undoubtedly due to high boiler efficiency. Crude oil is used extensively in the southwest, especially in Louisiana and Texas, and on the Pacific coast. Boiler tests with various kinds of coal are numerous. The tests in which fuel oil was used are much more limited as some of the best work has been done by boiler manufacturers and is not available to the general public.

2 During the last seven years, the writer has made more than fifty tests with fuel oil and has had a widely varying experience with this fuel. The best results can be attained only when careful attention is given to every detail of the boiler equipment. Burners for fuel oil use from less than 3 per cent to 12 or 15 per cent of the total steam generated. The arrangement of the furnace has been found to affect results to a marked degree.

3 The greatest loss in burning fuel oil undoubtedly comes from careless manipulation of draft openings and of the damper. Much of the writer's experience has been in the testing of irrigation plants of from 50 to 600 boiler h.p. capacity where the load was constant and the efficiency in the larger plants ought to have been high. Many of the tests were made to determine the actual conditions of ordinary running without offering any suggestions as to the best way to improve economy. In a great many plants the firemen leave the draft doors wide open and so long as no smoke appears they are satisfied, never questioning whether the amount of air is greatly in excess of that required for economical results. Under these conditions, boiler efficiencies ranging from 55 to 60 per cent are to be expected and the results show that such efficiencies are obtained. On the other hand, when acceptance tests of plants were made under a fuel guarantee and care was used in finding the proper draft area, and especially in the manipulation of the damper to maintain as high a pressure as possible in the furnace and around the heating surface of the boilers, the efficiency has ranged from 73 to 75 per cent.

4 The amount of fuel saved by an intelligent control of the furnaces is therefore a large item in the annual fuel bill. This fact has not been sufficiently brought home to the operators of power plants using fuel oil. No doubt there is much to be learned regarding the control of boilers using this fuel, and there is still a wide field for research work having for its object the conserving of fuel in the form of crude oil and pointing out a few simple rules to guide the operators of such boiler plants towards a more economical generation of steam.

THE AUTHOR. While the interest in this paper as evidenced by the discussion is very gratifying, it is disappointing that for purposes of comparison specific statements of economy have not been given for some of the more important Eastern and Western power stations.

2 During the last six or eight years, the steam-power central station has experienced apparently a wonderful development, and the fuel economy of these large stations is a matter of supreme importance to mechanical engineers. With modern systems for central-station records and cost-accounting, it cannot be that, privately, this subject has not received its full share of attention and study; yet, with perhaps one exception, the engineering public might search in vain the proceedings of our leading engineering societies, and even the technical press, for an authoritative statement of plant fuel economy in regular every-day service in any of these notable central stations.

3 During recent years there have been pronounced differences of engineering opinion regarding the selection of prime movers, and while these differences do not center on the question of fuel economy alone, this is, in most cases, a prime factor. It has become a custom in the selection of such apparatus to compare the steam consumption guarantees for various types at specified ratings, making reference to actual shop and plant tests as a warrant for the guarantee. It is a fact, however, that the final measure of economy is in the monthly maintained station fuel records, under actual service conditions and covering a wide range of load, rather than in shop or uniform-load tests. The engineering public are far more interested in these commercial fuel economies, than in mere statements as to steam consumption under ideal test conditions, or in speculations as to probable fuel economy based on an assumed steam economy; and in passing judgment on a matter of such importance, they are entitled to such fuel performance records.

4 The results of the official fifteen days' test of the Redondo plant were obtained on a commercial run under rapidly swaying railway load, and including all standby losses for each day during the four and one-half hour period of shutdown. It is common knowledge that there is a large discrepancy between such commercial load records and shop or uniform-load tests, a feature apparently overlooked by some members in discussing this paper.

5 The Redondo station operates in parallel with a waterpower station of about equal capacity. Practically all of the total load-variation is taken up by the Redondo engines, and as these swings correspond to those of a plant of double capacity, it follows that the rate and magnitude of load variations on each unit are about twice as great as on an ordinary or independently operated steam plant.

6 The writer has been keeping careful note of the monthly economy of the Redondo plant, in order to detect any failure, chargeable to the plant equipment, to maintain the economy as shown at the time of completion. There are external conditions—principally the intermittent failure of circulating water due to seaweed, and the operation of all or part of the plant non-condensing for intervals varying from a few hours to a few days per week—which for certain months have caused a falling off of the monthly economy by not more than from five to ten per cent.

7 But to answer properly Mr. Ennis, who apparently is under the mistaken impression that the record given was merely for a test condition, and who considers the economy stated "perhaps unprecedented if it is maintained in the ordinary operation of the plant," the writer can state that for the month of December, 1908, after seven months' operation of the Redondo station entirely under the direction of the regular plant operatives, the average economy, under similar conditions of load, etc., was even better than that obtained under the official test of the complete plant. Provided the plant upkeep is given ordinary attention, there is every reason to believe that the station will continue to maintain practically the same fuel economy; except during periods of unfavorable external conditions of the character outlined.

8 Several members have expressed the idea that compared with Eastern coal-burning plants the excellent fuel economy of the Redondo station is to be attributed wholly to the superior boiler-plant efficiency, when burning crude oil, and not to the economical performance of the prime movers, which, either by inference or conjecture, they would class as ordinary.

9 It is important to distinguish between the high efficiencies resulting from an absolutely uniform-load boiler test under ideal conditions permitting refined adjustment, and the performance under constantly changing railway load, with heavy swings and including not only a considerable period of operation at light load, but several hours of standby and radiation loss during each 24-hour period; and however good the gross boiler efficiency may be with oil fuel, there results a lower net boiler-plant efficiency, after making deductions for the steam consumption of oil burners, heating coils in oil-suction tanks, oil-pressure pumps and live-steam make-up in oil-pressure heaters, and after making the further uncertain allowances in the case of excessive moisture and sulphur in the oil, and loss by vaporization due to heating in suction tanks.

10 Judging by various general statements, there unquestionably prevails an exaggerated idea of the difference between this net boiler-plant efficiency when burning oil fuel, and when burning the best grades of anthracite and semi-bituminous coals, under the every-day commercial service conditions described, and even when using the automatic system of oil-firing. In short, the economy of this plant in view of the necessary losses in its various elements, under regular service as compared with test-conditions, indicates that not only was the boiler performance remarkably fine, as correctly indicated in the discussion, but that the individual performance of every element composing the plant was necessary of notable excellence.

11 In line with these considerations, Mr. Barrus and others have inquired for test data on the various elements of the plant. The only official tests made at Redondo are those given in the paper, and made under the control of the Testing Committee appointed by the contractor and purchaser. The only tests of individual elements were informal tests of short duration, in which the purchaser was not represented, and although they might be of service in estimating the performance to be expected in designing new plants they would not add to the value of the paper, when limited to the purpose for which it was written.

12 It seems to have been taken for granted by some that the writer is an enemy of the steam turbine, which is not so. All he desired was to bring out the fact that the piston steam engine is still an important factor in steam power plant design. On the present showing of Pacific Coast plants, he is compelled to favor the piston engine on the score of economy, but he does not wish to take a stand that either one or the other, or a combination of the two, will neces-

sarily be the most efficient, when all the elements which affect the every-day working of a power plant are considered. Under constant full-load "test conditions" the steam consumption of engines and turbines may be nearly equal, but under commercial service and on widely varying loads there may exist a marked difference in the respective fuel-economy records, and fuel economy is really "the proof of the pudding."

13 In answer to Mr. Kent—colder circulating water can be had in the East than in the West, and as the economy of the turbine depends largely on the vacuum obtainable, turbine plants installed in the West with 70-deg. circulating water will not show as favorable economy, either in steam consumption or the "coal pile," as plants in the East, where circulating water is available for a season at 35 deg. fahr., and where a vacuum of between 29 in. and 29½ in. is then obtainable.

14 Mr. Ennis states that the best records for Eastern coal-burning turbine plants are between two and two and one-half pounds of coal per kilowatt hour. If, as is probably the case, these stations are burning the best qualities of anthracite and semi-bituminous coal, then after making due correction for boiler efficiency, the Redondo station will still be ahead on the score of economy.

15 In estimating the probable economy of the Redondo engines, Mr. Ennis used a combined efficiency of engine and generator of 0.855, popularly assumed as a representative figure for steam engines, whereas that actually observed and stated in the paper is over 0.94.

16 Referring to the deduction of Mr. Bibbins, the writer again wishes to protest against theoretical considerations and calculated economies, either from prime movers to complete plants, or *vice versa*. Complete plant economy is not merely a product of engine and boiler performance, but involves many other well-known items of loss. There must be considered not only the uniform load test performance of boilers and engines at economical load, but also their poorer performance in the station on variable load, including light load and overload; and all other elements of station fuel-loss, including standby, starting and stopping, will decrease the actual every-day station economy, as compared either with the calculated full-load economy or that shown by a test of short duration. Hence, knowing the variable load economy of the complete plant, and say, the boiler efficiency, the calculated steam consumption of prime movers will be too great if these other items are neglected. Also if the boiler and engine test performance are known, the calcu-

lated complete plant economy is far too good if the other items of loss are neglected. Comparing with actual service records, Mr. Bibbins' calculation of one kilowatt-hour on fuel-consumption of 21,000 B.t.u. offers an example of the confusion resulting from such false analyses. If Mr. Bibbins and Mr. Kruesi would present to the Society some actual station fuel records, of their respective companies, either for Eastern or Western turbine plants, they would add to our store of such information, and perhaps encourage others to come forward with the same sort of data.

17 The writer's suggestion, commented on by Mr. Ennis, as to the establishment of a standard for comparison of fuel economies for power stations, had reference to the extension to complete plants of the standard set forth in the report of the committee of the British Institution of Civil Engineers, which referred only to the performance of steam engines, under different initial and final pressures and temperatures. An extract from this report is given in Ripper's The Steam Engine, Theory and Practice, p. 300. This cycle is designated by the above committee as the Rankine cycle, and is best known under this name, although previously known as the Clausius cycle.

18 The writer would emphasize the important difference in application between the standard proposed by the committee of the British Institution of Civil Engineers, and that proposed by the writer. The former refers to steam motors only, and the lower limit of temperature is that measured in the exhaust pipe near the engine. The latter refers to complete plants, including steam motor, boilers and auxiliaries, and not merely the prime mover; the lower limit is the initial temperature of circulating water and not the temperature in the exhaust pipe. The complete plant performance will depend on the efficiency of the condensing plant, and the nearness with which the vacuum approaches the lower temperature limit established by the entering circulating water.

19 Referring to Mr. Bibbins' remarks on the performance of engines at fractional loads; owing to the increasing number of expansions, and the benefits derived from the use of superheated steam, the Redondo engines actually improve, over rated economy, for a wide range of fractional load. And contrary to the prevailing opinion a good vacuum is very desirable for high engine economy, the benefit on fractional loads being especially notable. This improvement in engine economy at the lighter loads was so marked that the fractional-load losses in the remaining portions of the plant were equalized, giving for a fairly wide range of load a practically uniform fuel econ-

omy for the complete unit of engines, boilers and auxiliaries. The popular conception of the performance of the average engine on fractional load is so decidedly contrary to this, that the writer feels that he has established a significant fact in giving the curve of complete plant fuel performance.

20 To the writer's knowledge there was no consideration of increased flexibility in the inception of the four-cylinder engine, but this feature is not therefore of any less importance. The combination of the four-cylinder engine with twin condensers combines features of the utmost value, when considering the continuity of station output with a limited number of units, and also when operating in locations necessitating frequent cleaning of or tube renewals in surface condensers.

21 For the frequent special conditions at Redondo, of failure of circulating water and stoppage of condensers by seaweed, the twin-condenser arrangement is of the utmost value, permitting the cleaning of each condenser, while the entire engine exhausts to the other, thus losing between one and two inches of vacuum only. When the supply of cooling water is completely stopped by seaweed, the ability of the engines to carry the same heavy overload non-condensing, and this with high economy, is likewise a feature of great value, for on such service the effective capacity of any prime mover is its capacity when operating non-condensing.

22 Mr. O'Neil is apparently surprised, not that the actual result was so good, but that the guarantee was so poor, and he feels that this difference reflects on the ability of the engineers to determine the guarantee. This guarantee was not based on a calculated economy; it included the elements of standby loss, and variable load running, on which no data were publicly available. On the other hand, the guarantee was based on what information could be secured as to the actual performance of existing stations burning oil fuel. The contractor's initial proposal stated that the calculated economy of the complete station based on individual guarantees of apparatus, and uniform load at rating, would be 240 kw-hr. per bbl. of oil. As the existence of the Redondo station was dependent on the guaranteed cost of power, under commercial conditions of operation, its general manager later demanded a commercial load guarantee subject to a heavy penalty for failure.

23 Answering Mr. Moultrop's query as to the method of filtering cylinder oil from the feed-water, and the possible trouble from oil in the boilers, on account of the use of condensed engine exhaust as

boiler feed-water; owing to the limited supply of feed-water, it was impossible to break in the Redondo plant on raw water, and to throw the air-pump discharge overboard. An excess of cylinder oil was intentionally used in starting the engines, some of which passed by the feed-water filters and for a period caused the burning out of some of the lower row of boiler tubes. The quantity of cylinder oil was subsequently reduced so that the filters could remove enough oil to avoid difficulty with the boilers.

24 Most of the cylinder oil used by the engine is fed into the high-pressure cylinders, and this is largely eliminated by the oil separator diaphragm on entering the engine receiver, and trapped to waste. The steam entering the low-pressure cylinder is consequently comparatively free from oil. As but a small amount of cylinder oil is directly fed into the low-pressure cylinders, the total amount of oil in the condensed water is relatively small and as easily cared for by the filters. The filters are not of the pressure type, but receive water under atmospheric pressure, which passes downward through the filter by gravity. There are two filters per engine, each about 4 ft. in diameter by 5 ft. in height. In each filter are four horizontal perforated diaphragms for the support of the filtering material—usually hay—with which the filter is completely filled. The discharge pipe is so arranged as to submerge constantly all of the filtering material.

25 This general plan of filtration is in use in all Pacific Coast steam engine power plants having surface condensers, and has been successful for a period of years, although the same result does not seem to have been accomplished in Eastern power stations.

26 In view of the scarcity of accurate data as to power-plant performance, and the great difficulty of getting authentic reports tending either to prove or disprove the claims for various types of prime movers, it is to be regretted that a commission of disinterested engineers has not been appointed, to coöperate with some government bureau in obtaining complete data pertaining to the economy of all important power stations. The report of such a commission would officially stamp the correctness, or the incorrectness, of the economies claimed.

27 The writer is conversant with conditions in many Pacific Coast plants, and would be glad to coöperate with such a commission.

ARTICULATED COMPOUND LOCOMOTIVES

By C. J. Mellin. Schenectady, Published in The Journal for December

ABSTRACT OF PAPER

A locomotive articulated by the Mallet method consists principally of two sets of engines flexibly connected under one boiler, the rear, which is the high pressure engine of two cylinders, fixed rigid with the boiler and receiving the steam direct from the dome. The front or low pressure engine, also provided with two cylinders, is capable of lateral movement to adjust itself to the curvature of the road on the same general principle as a radial truck. The high-pressure engine exhausts into a receiver flexibly connecting the cylinders of the two sets of engines, from which the low pressure engine receives its steam supply and is exhausted from the latter through a flexible pipe to the stack. Each cylinder has its independent valve and gear connected to and operated with a common reversing rigging.

By this means the tractive power can be doubled over that of the ordinary engine for a given weight of rail with a substantial saving in fuel.

Mr. F. J. Cole. The type of locomotive described is singularly well adapted to a wider range of service than perhaps any other design. It was originally intended for narrow-gage roads of light construction built for military purposes, following the undulations of the country without grading, necessitating sharp curves and steep grades, in combination with light rails and the greatest economy in the construcion of track, bridges, etc. The characteristics of this design, namely, flexibility and uniform distribution of weight combined with the use of two separate engines which would not slip at the same time, rendered the design very attractive for these narrow-gage railroads.

2 The first engine of this class was built about the year 1887 and at the present time there are approximately 500 running in Europe. Some five years ago the Mallet locomotive was introduced in this country and its merits and efficiency have been recognized by railroad men wherever they have been put in service. The three articu-

lated engines designed and constructed for the Erie Railroad for use on the Susquehanna grade, of the 0880 type, are the heaviest and most powerful locomotives ever built and operated,

3 When we compare the early locomotives of this type and their work on light narrow-gage railroads, with those built last year for the Erie Railroad, where each engine took the place of three standard 100-ton consolidations, we at once appreciate the great range to which this general class of articulated locomotives is adapted. A locomotive must possess peculiar inherent qualities to enable it to perform so satisfactorily such a wide range of service, from two-foot narrow-gage roads to main line work on leading trunk lines, utilizing the extreme limits of axle loads and adhesion.

4 Some of these distinctive features are:

a Short rigid wheel base, ranging from about 2 ft. 8 in. to 14 ft. 3 in.

b Rigid connection of high-pressure steam-pipes to the rear engine, permitting steam connections between the boiler and cylinders in the ordinary way, without the use of flexible connections.

c Flexible steam connections to the low-pressure cylinders, which are easily kept tight, as a receiver pressure of only about 70 lb. has to be provided for and the packing for this pressure is not a difficult problem.

d Extreme flexibility; forward group of driving wheels, operated by low-pressure cylinders, swing freely when passing curves.

e The articulated locomotive is essentially a compound proposition presenting many advantages over the use of four simple cylinders. These engines cannot be designed as simple engines and work as satisfactorily as the present arrangement of compound cylinders, because this would necessitate the use of high-pressure flexible steam pipes and introduce other complications.

f The total weight being carried on the drivers, makes it possible to use a very high tractive power, especially valuable for pushing and helping service.

g Impossibility of both engines slipping at the same time, the receiver pressure automatically taking care of this. If the high-pressure engines commence to slip, the receiver pressure will be increased and produce greater back pressure on the high-pressure pistons, and consequently

greater pressure will be admitted to the low-pressure pistons, resulting in alternating slipping from one engine to the other. This is of great value in hill climbing.

5 Considering the matter of axle-loads, this type presents many advantages because from four to eight driving axles can be employed. The limitations of the consolidation or 280 class are:

200,000 lb. on drivers,	50,000 lb. axle load
220,000 " " "	55,000 " " "
240,000 " " "	60,000 " " "

In the decapod or 2-10-0 type we have these limitations:

250,000 lb. on drivers,	50,000 lb. axle load
275,000 " " "	55,000 " " "
300,000 " " "	60,000 " " "

6 The use of 2-10-0 type, however, is very questionable except with small wheels on account of the extremely long rigid wheel base, with its necessary accompaniment of extreme flange-wear and friction in passing any but the longest radii curves. With the Mallet articulated engine a much wider range of driving wheel loads is permissible. The 0660 type permits the following loads:

300,000 lb. on drivers,	50,000 lb. axle load
330,000 " " "	55,000 " " "
360,000 " " "	60,000 " " "

The 0880 type permits the following weights on drivers:

400,000 lb. on drivers,	50,000 lb. axle load
440,000 " " "	55,000 " " "
480,000 " " "	60,000 " " "

7 The above figures show the possibilities of building locomotives of enormous tractive power larger than that possessed by any other type. The wide range of permissible axle-loads and the great flexibility, in combination with the economy produced by compounding, especially in slow service, all tend to make the design particularly well adapted to a wide range of work.

8 The ease with which these engines are fired is a matter of general surprise. This is largely due to the use of compounding, which reaches its maximum efficiency at slow speeds and long cut-offs, whereby the work of the fireman is materially reduced.

9 In ordinary service, especially for helping and pushing, the entire weight is needed for adhesion and no useful purpose is served by the additional complication of leading truck wheels. No sharp flanges have developed on the Baltimore & Ohio 0660 type after four years of service. This locomotive has been operated 24 hours per

day pushing up hill and backing down over sharp curves without detrimental effects; while the ordinary consolidations in use on this road do wear their flanges badly. This proves conclusively the extreme flexibility of this type and its ability to move freely around curves without the use of guiding wheels. The ease with which a six-wheel Pullman car truck passes around curves, presenting an almost ideal construction for this purpose, explains this freedom from flange wear. It can readily be seen that the front low-pressure engine of the Mallet locomotive of the 0660 type is really nothing more than a large six-wheel truck and it seems quite as unnecessary to add leading truck wheels to an engine of this kind for ordinary conditions as to add a leading wheel to the six-wheel car truck.

10 The sliding support carrying the weight of the boiler is located in a position to equalize wheel loads, and by swinging links between the front of the rear frames and the back of the front frames, extreme refinement can be made in the equalization of weight, so that the wheels may be equally loaded. The employment of leading or trailing truck wheels does not seem to be necessary except for the possible use in road service where speeds exceed 35 and 40 miles an hour and the boiler requirements are such as to make it impossible to utilize the entire weight of the engine for adhesive purposes. The only justification for their use seems to be in cases where the extreme boiler capacity is required. In the operation of trains at good speeds, the boiler capacity is the chief requirement and the tractive power a secondary consideration; as in the case of Atlantic or Pacific engines, where a great deal of adhesive weight is sacrificed for the purpose of obtaining greater boiler capacity.

11 Two years ago, in discussing Mr. J. E. Muhlfeld's paper on large electric and steam locomotives before the New York Railroad Club, I called attention to some advantages of this design for heavy service, among which were the following:

a Ease of turning the engine around on a "Y" of 23 deg. with no grinding of flanges and almost entire absence of flange friction, the engine appearing to pass the curves as easily as a car with the ordinary forms of trucks.

b Absence of any unusual exertion on the part of the fireman in maintaining steam pressure.

c The power reverse gear making much less made the engine very easily operated, so that much less exertion was really requiredto reverse or alter the cut-off, which involves moving four valves therein the ordinary two cylinder engine.

12 The question of guiding trucks was also considered, and the opinion which I found at that time was that their use was unnecessary and their only effect would be to complicate the design without serving any useful purpose. The two years which have elapsed since that time have merely tended to confirm this opinion and the absence of flange wear on the front driver at the present time bears testimony to the inherent flexibility of this design for use on roads having sharp curves.

Mr. Harrington Emerson. A few years ago Mr. B. J. Arnold, a prominent electrical engineer, stated that there was no known way of moving freight as cheaply as by putting a steam locomotive ahead of a train. During the last few years there has been an attempt by electrical engineers to rush the subject, and to pretend that the steam locomotive is obsolete. They proved their case by assuming ideal conditions for the installation of electric traction, assuming at the same time that current locomotive practice is the best obtainable.

2 Two things have occurred in recent times to put far into the future this electrification of all railroads. One is the panic, by which railroad managers have been reminded that it would be expensive to depreciate and make obsolete all their existing power as well as round-houses and division points: the other factor is the Mallet type of engine.

3 Before the Mallet was developed, locomotives had been lengthened out until we had for mountain grades the famous Santa Fé type, with its 34-ft. wheel bases. That locomotive operated very economically, carrying loads for less than any electric installation could possibly have carried them.

4 I remember a discussion between a former superintendent of motive power, and the general manager of the Santa Fé system, in which the latter accused the superintendent's locomotive of spreading the track so that nothing could run over it. The superintendent replied that it was the business of the general manager to keep the track in order. The question of the wheel base, which was the limiting question in the old type of locomotive, is obviated in the Mallet type, so that for many years the Mallet will be found operating with the highest economy on mountain grades.

5 There is a difficulty with the Mallet that was also experienced with the Santa Fé type. I was once with the superintendent when he received a telegram that one of the locomotives was off the track.

He wired to find what speed she was running at, and the reply came that the locomotive was not running at all, but was standing still. The superintendent remarked, "We are up against it when locomotives jump the track when standing still." That difficulty may also be experienced from the heavy weight of the Mallet on drivers.

Mr. L. R. Pomeroy. The paper and discussion thus far have been confined mainly to questions of design and construction. The speaker desires to call attention briefly, to some of the commercial advantages of the Mallet type.

2 Generally speaking, the gain to be expected, from the substitution of electric for steam operation, depends greatly on the density of traffic coupled with the frequency of units. And further, if it is not possible to accomplish by electric service something now impossible with steam service, then the adoption of electric service is not commercially practical, for there is nothing to be gained, *per se*, by the mere substitution of one kind of power for another.

3 This at once suggests the question of capacity. On certain mountain grades where the maintenance of expensive helper service is necessary, about all that can be figured out in favor of electric haulage, owing to the limited volume of business in the particular case, would be that the tonnage per train on a given grade or section could be nearly doubled, or the train mileage halved, without a corresponding increase in train-crew expense.

4 For instance, a 50-mile mountain section having a maximum grade of 2.2 per cent, with seven trains per day in each direction. The reduction of one-half in train mileage with the same tonnage at 50 cents per train mile, the rate covering the items directly affected as used in computing the saving or advantages in grade reduction, would amount to $65,000 per annum, and this amount capitalized at 6 per cent would equal about $1,000,000. But to obtain this saving electrically the complete electric apparatus would probably cost considerably more than this capitalized amount, whereas the requisite number of Mallet compound steam locomotives to perform the service would cost about one-third of the amount necessary for an equivalent electric service.

5 To state the case another way, i.e., based on train-crew saving only, leaving out entirely all other advantages. The total of 14 trains is the equivalent of about 700 train miles per day and the cost for

train crews amounts to from 12½ to 15 cents per train mile. Then the saving per annum will be

$$\frac{700 \times 0.14 \times 365}{2} = \$17{,}800$$

This amount capitalized at 6 per cent equals about $300,000, or more than enough to pay for the required number of Mallet locomotives to perform the service.

6 The foregoing is not meant to be a reflection on electric possibilities, *per se*. The particular case cited does not possess the inherent magnitude of business to warrant or justify an electric proposition, but it does show that until future conditions change there are a great many cases where the Mallet type of locomotive will serve as a profitable bridge over the deep chasm between present conditions and the eventual supremacy of the electric locomotive.

Mr. George L. Fowler. As I was coming up the stairs a few moments ago I met Professor Goss, who was about to leave the building, and he asked me to say a word for him. He wanted me to call attention to the fact that when Mallet designed his locomotive, it was designed for narrow gage roads, and for comparatively light traffic, as has already been mentioned in the discussion, and when an attempt was made to apply this principle to the tremendously heavy locomotives required for American service, such as we have in the Great Northern, Baltimore & Ohio and Erie engines, the problem assumed a magnitude which Mallet probably did not consider when he first designed his engine, so that in taking that principle and adapting it to the heavy locomotives of American practice, great merit must be given to the designer of the first heavy Mallet engine in this country, the gentleman who presented the paper to you this afternoon, Mr. Mellin. This is for Professor Goss.

Mr. George R. Henderson. The only thing I want to note is the necessity in these large engines for a pretty liberal supply of fuel, and possibly a liberal supply of men to put it in, unless we use liquid fuel, or have some mechanical means of putting coal in the fire-boxes. Take one of the Mallet engines with 80,000 lb. tractive force, and attempt to use that force at a speed of anywhere near 15 miles an hour; a large amount of coal, five tons, or 10,000 lb., an hour, would be called for in the fire-box, and I think it is time for those interested in mechanical stokers to suggest a practical means of supplying this

fuel to the engines, so that they may not merely pull cars at slow speed, but give a fairly good return in horse power developed for money invested.

Mr. Alfred Lovell. The Mallet articulated locomotive presents an opportunity to utilize steam by double expansion without increasing the number of working-parts over those required for single-expansion engines of corresponding weight and power, and to increase further the economy thus secured, by the introduction of superheating; an advantage touched upon only lightly by the author, and deserving of a more complete recognition.

2 The key-note of present-day engineering thought and activity is the conservation of resources, as was impressed upon us by the valuable address of the President of the Society at the opening of the December meeting.

3 In this address it is stated that under the best conditions that prevail in stationary power plants not more than 15 per cent of the heat value of the coal used is utilized in actual work produced at the engine, and that under average conditions a considerably smaller percentage is realized. The best conditions referred to evidently contemplate the multiple expansion principle in the use of steam. In the best locomotive practice the conditions are still less advantageous for the utilization of the heat value of fuel, and in average locomotive service the percentage is probably much less than in average stationary plants. In the locomotive tests at the St. Louis Exposition in 1904, the work at the draw bar, not including engine friction, represented a percentage of the heat value of the coal ranging from about $3\frac{4}{10}$ per cent in simple engines at high speed, to about $8\frac{6}{10}$ per cent in the best compound engines at low speed.

4 Good engineering practice thus demands that locomotives be so designed as to increase to a maximum the utilization of the heat of the fuel, and without excessive complication that might result in excessive maintenance cost, or delays to service.

5 In Europe the advantage of double expansion in locomotive practice has long been recognized. In American railway service, the last twenty years have demonstrated absolutely that the compound use of steam in locomotive service results in a substantial saving of fuel, the percentage ranging from 5 to 40 per cent, according to the character and conditions of service. It has also been demonstrated that in long continued service, covering several years,

boiler repairs are less with the compound, due to less demand for steam and milder exhaust.

6 When the compound locomotive was first built with four cylinders and their complement of pistons, piston rods, and rod and valve packing it was found that notwithstanding the decreased boiler wear, the liability to disorder from breakage or wear of engine parts, on account of the slightly increased number of wearing parts, sometimes quite offset the advantage of fuel economy. The cross compound or two-cylinder type, high-pressure on one side and low-pressure on the other, was expected to overcome this objection, and these were built in considerable numbers for several years succeeding 1895.

7 Experience proved that under certain conditions this latter type developed unequal or twisting strains in the opposite sides, sometimes resulting in breakage of frames and other parts. Moreover, the demand for increased size of units of power soon brought the low pressure cylinder in the two-cylinder compound to the limit of size permissible. The result was a further development of four-cylinder compounds, and the tandem and balanced compound types were produced.

8 Both of these types are good fuel savers, and are free from some of the objectionable features of the earlier types, while the tandem gives opportunity to construct units of great size and power. Yet the slightly greater number of working parts, and the anticipated or actual difficulty of reaching some of these parts in making running repairs, cause many to reject them and to perpetuate the wasteful method of using the steam single expansively.

9 The articulated compound locomotive bids fair to overcome these objections entirely. This locomotive is in effect two engines with one large boiler and one fire-box. The two engines together use the steam double expansively, and with no more cylinders and working parts than two single-expansion engines. Boiler repairs should be relatively small since the minimum of steam is required and the exhaust is mild. Wearing parts of engines are easily accessible.

10 One engineer operates both engines as readily as one four-cylinder engine. Owing to the economical use of steam, one fireman can stoke a locomotive of this type having very large tractive power. The type thus provides means for the economical use of fuel with a minimum of labor and no increase of disorder delays, or in engine repair cost, and with a probable reduction in boiler repair

cost as compared with single-expansion locomotives of corresponding power.

11 Superheating of steam in locomotive practice has been shown to effect fuel economies in single-expansion locomotives nearly or quite equal to those secured by compounding. It is probable that with proper arrangements a combination of double-expansion, and of superheating the steam before using, or reheating it between the high and low pressure cylinders, will give greater fuel economy than either compounding or superheating alone. The flexibility of arrangement possible in this type of locomotive presents a most advantageous opportunity for this combination.

12 The necessities of the future will demand in locomotive practice the greatest possible conservation of skilled labor and of fuel, and for the reasons mentioned the Mallet articulated compound locomotive is worthy of the spirit of the day, and will perform an important part in the economies of the future.

Mr. S. M. Vauclain exhibited a large number of lantern slides of which he gave an interesting running account by way of discussion of the paper. These related to the initial work of Mallet in the development of the type of locomotive that bears his name and to locomotives of this type built by the Baldwin Locomotive Works. He said: "It is not my purpose to criticise the admirable paper of Mr. Mellin; but merely to preface my discussion with remarks to the effect that I do not coincide with the author in all his conclusions or in his treatment of the principles upon which Mr. Mallet has spent so many years of his most useful career. One design of this most flexible type of locomotive may be so treated as to include many devices considered entirely unnecessary by the inventor, yet on the other hand it is quite natural to make additions or changes common to American practice and suggested by years of experience on American roads. It is not my purpose to discuss the details of the paper but to add what is most lacking, a historical sketch giving the fullest honor to the original inventor, and to show the development of the subject in the United States from the standpoint of our progressive railroad men.

2 "It was Mallet who, in 1875, started the era of economics in locomotive building destined to keep all minor lights in locomotive building fully occupied. He did this by means of a two-cylinder or cross-compound locomotive of Roentgen type built at Creusot for the Bayonne & Biarritz Railway. In 1877 he recognized the ineffi-

ciency of this type, since proved in America, and adopted the more sensible four-cylinder tandem type. But so rapidly did his mind work that during the same year he changed from the tandem type to one in which the cylinders were coupled to separate systems of wheels and operated independently, but with one supply of steam. His idea was either to use a rigid frame or to articulate. The De-Glehm engines, the first of which was built in 1885 for the *Chemin de Fer du Nord* and later for the Paris, Lyons & Mediterranean, were of the former or solid-frame pattern. He shortly thereafter successfully introduced the articulated frame which is considered a characteristic feature of the type which now bears his name, and we owe to Mr. Mallet all the honor that may ensue from its introduction in this country. It is to be regretted that, like Walschaerts, Mallet is unable to realize the full benefit of his inventions, owing to the time limit of the patent law.

3 "The Baldwin Locomotive Works recognized the merit of Mallet's invention and in 1889 made a careful investigation of the engine used by the Decauville Railway at the Paris Exposition. Numerous efforts were made to interest both foreign and domestic railroads, and Mr. Mallet personally assisted in planning the general types. The first design for a domestic road was submitted to the Erie Railroad in 1898, and it was at that time considered a very heavy locomotive.

4 Many designs were worked out for J. W. Kendrick, Second Vice-President of the Atchison, Topeka & Santa Fe Railway. The later designs of this series had an intermediate chamber to overcome the objectionable length of tubes, fire-box combustion chamber, and leading and trailing trucks. In one of the designs for passenger service it was intended to produce a locomotive, with superheater, of sufficient power for the heaviest train on grades of two per cent and less.

5 The design finally proposed by Mr. Kendrick had a reheater between the high and low pressure cylinders through which the steam must pass on the way to the low-pressure engine, and also a feed-water heater. The cylinders in this engine face each other as in previous design for freight service.

6 Designs were proposed for freight service, embodying the jointed boiler feature having cylinders facing each other, open combustion chamber covered by a movable cap, etc. The design finally adopted for freight service for this railroad had a reheater, superheater and feed-water heater, and a detachable front section making

all parts readily accessible. The final type agreed upon for passenger service has five pairs of driving wheels, a four-wheel leading truck and a two-wheel trailing truck.

7 One of the first to recognize the merit of the Mallet type of locomotive was J. J. Hill, who ordered five of these locomotives. A design of a locomotive without a truck was first submitted, but he demanded a trailing, as well as a leading, truck, and experience with this arrangement has proven his diversion from previous practice to be justified. This was also in accordance with our own preference.

8 On the Great Northern Railway, 67 engines of the Mallet type are now in use working on grades of from 0.6 per cent to 2.2 per cent. The speaker had received from Geo. H. Emerson, Superintendent of Motive Power of this road, data upon the performance of some of these engines, which he submitted in abstract. These are given in full under Mr. Emerson's name in the discussion immediately following.

9 Engines designed for service on the Mexican Central were then referred to, and a résumé was given of designs proposed for the Southern Pacific and worked out at the solicitation of J. Kruttschnitt. The first design had no trucks, no tender side tanks being employed. The side tanks, however, reduced the boiler capacity and the coal box was inadequate. The second design provided for separate cabs for the engineer and the fireman. The engineer was placed forward and the fireman in the rear. A combustion chamber was employed in the third design in order to reduce the length of flues to a reasonable figure. The fourth design was made to overcome the objection of small driving wheels; in it were employed all the possible details of the Harriman common standards. This design shows a logical outcome, and two locomotives of the type are now in the course of construction. The low-pressure cylinders are detachable, the boiler is separable and the steam from the high to the low pressure cylinders passes through a Vauclain reheater.

10 In closing, the speaker referred to a special design of his own, differing from that of the Mallet type previously noted, in having a flexible boiler instead of provision for sliding contact for the front end of the boiler to the supporting member of the frame, providing the necessary lateral movement in rounding curves. The boiler is in two sections, each firmly secured to its own cylinders, and frames hinged after the Mallet design, but the two sections of the boiler joined by a flexible connection between the two smoke chambers containing the superheater and the reheater.

Mr. G. H. Emerson. In October 1906 the Great Northern Railway received five large Mallet engines, the two high-pressure cylinders being $21\frac{1}{2}$ in. in diameter by 32 in. stroke, the two low-pressure cylinders located on forward engine 33 in. in diameter by 32 in. stroke: boiler pressure 200 lb.; weight on drivers 316,000 lb.; total weight of engine and tender loaded 503,200 lb.; diameter of drivers 55 in.; engine having two-wheel pony truck, three pairs of drivers on front engine with three pairs of drivers followed by two-wheel trailer on rear engine; boiler having total heating surface of 5700 sq. ft. and grate area of 78 sq. ft.; maximum rigid wheel base on either engine, 10 ft. This engine will be referred to hereafter as class L-1.

2 The largest engines heretofore used by this company were the consolidation F-class having cylinders 20 by 32; carrying 210 lb. boiler pressure; 180,000 lb. on driver; total weight of engine and tender 318,000 lb.; total heating surface of boiler 2768.4; total grate area 59.2; diameter of drivers 55 in.

3 The five large class L-1 Mallets above referred to were purchased as helpers on heavy grades and were placed in service on the Cascade Mountains between Skykomish and Leavenworth, where the ruling grade is 2.2 per cent. East from Skykomish there are 22 miles of continuous 2.2 per cent grade with a let-up through the Cascade Tunnel of 1.7 for a distance of three miles. West from Leavenworth there is almost a continuous grade of 2.2 per cent for a distance of 32 miles ending at Cascade Tunnel station. The engines were put to work on this hill in helper service to take the place of the consolidation F-8 type as pusher and to help an F-8 engine used in road service between Leavenworth and Delta, a distance of 109 miles.

4 The engines were so large they could not be taken care of with the facilities provided. As they could not be turned around without providing further facilities, they were designed with pony truck in front and trailer behind and during the first winter's service, therefore, they were not turned nor were they taken into a roundhouse.

5 Soon after receiving these engines tests were made to determine the tonnage which they could handle, and their economy as compared with the consolidation engine. One L-1 was first used as a helper engine with an F-8 as a road engine and it was found that the two engines could easily handle 1300 tons up the mountain. It was further developed that while the F-8 handled only 500 the L-1 handled 800 tons of the train, using no more coal with this load, and in fact somewhat less, than the consolidation with her part of the train.

6 The first winter's performance was so favorable to the Mallet engine, both from an operating and a maintenance standpoint, that arrangements were made for additional Mallets, as it had been decided they could be used in road service as well as on hill service, and in May 1907 25 road Mallets were received, somewhat smaller than the first ones purchased, their high-pressure cylinders being 20 by 30; low pressure 31 by 30, 200 lb. boiler pressure; 250,000 lb. on drivers; total weight of tender and engine 451,000; total heating surface 3914; grate area 53.4 sq. ft. The general design of this engine was the same as that of the former one, except that it was of smaller dimensions, and the boiler provided on the engine was identical with the boiler used on Prairie and Pacific engines having cylinders 22 by 30 with 69-in. drivers, carrying 210 lb. steam pressure. This last or road class will hereafter be designated as L-2.

7 These engines were put in service on a section of the road where there is a 1 per cent grade and showed themselves so economical that in May 1908 further Mallet engines were received as follows: 17 type L-1 and 20 type L-2, it having been decided to extend the use of the Mallet engines to districts having grades as low as 0.72 per cent.

PERFORMANCE ON CASCADE DIVISION

8 Distance from Leavenworth to Everett, 108.70 miles; ruling grade, both directions, 2.2 per cent; total ascent: west, 2192, east, 3376.

9 On the main line of the Cascade Division between Leavenworth and Everett, the Mallet class L-1 engine has superseded the consolidation F-8 class. As explained in Par. 3, the large Mallets were first introduced on the hill between Skykomish and Leavenworth with consolidation train engine and L-1 helpers used on the hill only. Up to the present time the tonnage taken over this mountain has been gradually increased from 1050, with two consolidation engines, to 1600 tons now being hauled with L-1 engines. The L-1 engines have replaced the consolidation engines and it is now the practice to start out from Everett with one L-1 engine used as a road engine taking 1600 tons as far as Skykomish over a ruling grade of one per cent. At Skykomish another L-1 is put on as a pusher and the two engines take the 1600-ton train over the mountain. The tonnage hauled in the opposite direction is the same and the L-1 or large Mallet helper has proved herself not only worthy of helper service, but a good reliable road engine, and the combination of road and helper service

works out admirably on this division, making it unnecessary going east to reduce the tonnage at Skykomish in order to get over the heavy grade.

10 Recent performance shows that on a round trip over this division the L-1 engines handled 1600 tons with a total of $43\frac{5}{6}$ tons of coal or equivalent to 25.13 lb. of coal per 100-ton mile. The F-8 consolidation type could handle only a 1050-ton train, with practically the same amount of coal, or equivalent to 38.29 lb. of coal per 100-ton mile. In other words, the tonnage on this division has been increased at least 52 per cent with a saving of 34.39 per cent lb. of coal per 100-ton mile, due to the Mallet engine. The pusher engines on this district are allowed only switching mileage, that is, 6 miles per hour while in actual service, and for this reason it is somewhat hard to make a comparison with other engines, as they will take the 1600-ton train over the mountain on the hardest pull at a speed of not less than 8 miles per hour.

11 A good showing in repairs is made by the average of 22.33 cents per mile for the year ending June 30, 1908, especially when it is considered that during this period the engines were exclusively in pusher service. Since putting L-1 large Mallets in road service to replace all the consolidation type, the performance has been so satisfactory that only four are now used as pushers exclusively, two as helpers over the Cascade mountains and two on the Butte Division in transfer service.

PERFORMANCE ON SPOKANE DIVISION

12 Distance from Spokane to Leavenworth: 197.40 miles; ruling grade, both directions, 1.0 per cent; total ascent: west, 1351, east 2186.

13 The 1600 tons delivered from Cascade Division at Leavenworth are here reduced to 1450. A small Mallet L-2 takes this train to Hillyard, a distance of about 202 miles. Here too the hauling capacity of the Mallet engine has made possible an increase in tonnage from 1100 tons hauled by the consolidation to 1450 tons, an increase of 31.8 per cent. The run is so long that this tonnage of 1450 has been established by this division in order to get trains over the district in a reasonable time. Engines have not been loaded down to mere drags, but the L-2 Mallet engine handles this tonnage, from 8 to 10 miles per hour on the heaviest hills, up to 30 miles per hour over portions of the district where the grade is not so hard.

The performance for the year ending June 30, 1908, shows 22.04 lb. of coal per 100-ton mile on this district, a saving of 27.5 per cent over a consolidation.

PERFORMANCE ON KALISPELL DIVISION

14 Distance from Cutbank to Whitefish, 127.88 miles: ruling grade: west, 1.0, east, 1.8 per cent; total ascent: west 1613, east 2305.

15 On the Kalispell Division, which is the next division east where Mallet engines are used, the L-2 engine takes a train of 1700 tons from Whitefish to Essex, where the ruling grade is 0.8 per cent. At Essex a large L-1 helper is put on to help the train up to Summit, a distance of 18 miles, where the ruling grade is 1.8 per cent. West bound, L-2 engine takes a train of 1450 tons from Cutbank to Whitefish, ruling grade being 1 per cent. On this district replacement of the F-9 class consolidation by the Mallet engine has increased the tonnage 20 per cent with a corresponding reduction in coal per 100-ton mile of 20.7 per cent.

PERFORMANCE ON MONTANA DIVISION

16 Distance from Havre to Cutbank, 129.37 miles; ruling grade: west 1.0, east 0.8; total ascent: west 1952, east 712.

17 From Cutbank to Havre, another L-2 Mallet engine carries through the 1700 tons delivered from the Kalispell Division. Going west from Havre, the L-2 road Mallet handles 1450 tons. The round trip on this division with L-2 engine is made with 32 tons of coal, or equivalent to 15.75 lb. of coal per 100-ton mile. F-7 consolidation previously used, requiring the same amount of coal, handled only 1200 tons west and 1425 east, or equivalent to 18.9 lb. of coal per 100-ton mile, showing a decrease by the use of the Mallet engine of 16.6 per cent of coal per 100-ton mile, and an increase of 20 per cent tonnage.

PERFORMANCE ON MINOT DIVISION

18 Distance from Minot to Williston, 120.83 miles; ruling grade both directions, 0.72 per cent; total ascent: west 1069.7, east 777.1.

19 Here the L-2 small Mallet has replaced the F-8 consolidation, having increased tonnage from 1600 to 2200. The L-2 engine makes the round trip on 30 tons of coal, or equivalent to 11.29 lb. of coal per 100-ton mile as against 15.49 lb. of coal per 100-ton mile for consoli-

dation, having increased tonnage 37.5 per cent with performance of 27 per cent less coal per 100-ton mile.

PERFORMANCE ON BUTTE DIVISION

21 There are now two L-1 engines in transfer service between Butte and Woodville, where the ruling grade is 2.2 per cent. Their performance compares very favorably with that on the Cascade Division.

22 The L-2 engines have done good road service between Clancy and Woodville, on this division, replacing the F-8 engines where the tonnage was increased from 550 to 700 tons going west over a 2.2 per cent grade and from 1200 to 1650 going east. Owing, however, to another part of this branch having been washed out in the early summer, and track conditions not allowing for the handling of heavy trains east of Clancy, the Mallet engines between Clancy and Woodville were taken to other divisions until such time as the handling of heavy trains on this district would be warranted. The two Mallets in transfer service between Butte and Woodville, however, are still retained in service and are doing business formerly done by five consolidations.

GENERAL

23 The performance of Mallet engines above referred to by divisions shows their economy in fuel, also how they have increased the tonnage per train and thus cut down the cost of train service, as it may be said that two trains with Mallet engines have replaced three trains hauled with consolidations.

24 The cost of maintenance one would naturally expect to be higher on the Mallet engines, but for the year ending June 30, 1908, the cost of repairs on the L-2 road engines was 10.47 cents, which we do not think at all excessive when it is considered that we have two pairs of cylinders and two engines but only one boiler to maintain. The cost of maintenance on consolidation engines in the same service is very seldom less than eight cents per mile.

25 Another feature which has been noticed from the start is that the Mallet engine is not at all hard on draw bars, principally because it is not possible in starting a train to slip both sets of drivers at the same time, so that the train is not jerked as it would be by a simple engine slipping and catching. When the Mallet engine does slip it is usually the high-pressure engine which slips first. This naturally builds up the receiver pressure and will cause the low-pressure engine

to slip until the receiver pressure is worked down and the engines get down to equal work.

26 The tire-wear on these engines is very light and the flange-wear is also not excessive. In fact, Mallet engines have been put in on some districts where the flanges on consolidations would cut badly, and no appreciable flange wear has been noticed on the Mallets, no doubt on account of the short rigid wheel-base as well as the guiding pony truck. It is hardly necessary to state that the Mallet engine with its rigid wheel base of only 10 ft. and axle load not to exceed 50,000 is not hard on the track.

27 We still have in service two of the first L-1 Mallet engines, which have never yet been in the shop for general overhauling, in fact, have never been off their wheels, but have been in continual service since October 1906, with the exception of light roundhouse repairs. The above performance would seem somewhat exaggerated, in fact the correctness of these statements has very naturally been questioned on several occasions by motive power officials not acquainted with the Mallet engines. Fortunately, however, some of them have had the privilege of investigating for themselves and I think it can be fairly stated that no one who has seen them in operation has been disappointed with their performance. While not wishing to say anything to retard the progress of the electric locomotive, we cannot help feeling that the introduction of the Mallet engine has set back the introduction of the electric locomotive for a great deal of hill service, as the Mallet performance has set a new figure for economical performance.

THE AUTHOR. It seems from the discussion that the only point of difference in opinion is whether a truck should be used or not. Its necessity cannot be proved by simply putting it there, but by omitting it, and the numerous cases of observation of engines properly designed with the omission of the truck prove conclusively that it is not required, and have in every way borne out the argument made in the paper for its omission. If a railroad, however, insists on having the truck and carries the responsibility for the service of the engine, it will of course have to be applied, but they would do better to leave it off, as it necessarily reduces the efficiency of the engine by its added resistance.

2 Mr. Vauclain said that European builders have applied the trucks on this type of engine, but so far as this is done it has generally been confined to engines with only two pairs of driving wheels in

each set of engines, and where the curvatures have been so sharp that so short a wheel has been considered insufficient for the safe guiding of the engine, or in some cases where the builders and the roads ordering such engines have been in doubt as to their qualifications and have therefore added the trucks as a safeguard.

3 The oldest and most successful users and builders of this type of engine do not apply the truck, with an occasional exception of the two-axle class referred to above.

4 I heard with pleasure Mr. Vauclain's high tribute to Mr. Mallet, in which I join most heartily and hope that he may live to see his labor fully recognized, which is seldom the case with the prominent men who are in advance of their contemporaries. In regard to the cross-compound engine, however, Mr. Vauclain's statement that it has proved to be on a wrong principle will need some modification, so far as this continent is concerned. There are cross-compound locomotives in use which have shown for years a saving in fuel of from 25 to 40 per cent from the start to the present day. One of the greater trunk lines has for the last ten years built this type of engine exclusively, for its heaviest freight service, amounting to several hundred engines, and has found by frequent and thorough tests (the latest within the last few months) that performances are as good today as they were ten years ago, these engines hauling 45 per cent more load than the simple engines, to the same amount of fuel. They find them also considerably easier on repairs, using one set of tubes, to two sets on the corresponding simple engine, and they make 20 to 30 per cent more mileage between the repairs. These facts can be verified by anyone interested, by personal inspection, as they are in service every day, and I have no doubt but that the officials of the road will give any desired information about them.

5 The continuously increasing weight of the locomotive in general necessitated the compound to follow, and when 220 000-lb. engines were required, the size of the L. P. cylinder became too large for the limited clearances on most roads; the articulated type of engine described is simply an outgrowth or duplication thereof in all its essential features and advantages, with the adoption of the Mallet principle of articulation. With the expectation that the discussion would bring forth some particulars as to the performance of this engine, reference to it was purposely omitted from the text of the paper, and a few points of comparison with the 100-ton simple engines used in the same service may be of interest.

6 In pushing-work it took the place of two of these engines and

did the work with ease. Special attempts were made to stall it by shutting off the front engine on the heaviest grade under full load, based on the capacity of three of the other engines, but it pushed both train and front engine to the top of the grade.

7 In road service it is rated to 2400 tons over a given division where two of the 100-ton simple engines are rated to 2200 tons (double headers), consuming practically the same amount of fuel as one of the simple engines. In order to find out the maximum power of the engine it was decided to make up a train of 2700 tons weight, but this did not stall the engine and another train of 2900 tons was tried with the same result; apparently no further attempt to stall her by overload has been made.

8 Another engine of this particular type and practically the same size has shown fully as good results in an entirely different kind of service, namely, pushing a snow-plow, where its extreme power at slow speed comes in most advantageously. Under these conditions it has successfully handled the snow-plow alone where the ordinary engine will stall and where it formerly required five 100-ton engines to do this work on various occasions.

9 One of the Erie engines, referred to by Mr. Cole, on one occasion started a train of four ordinary engine loads and the front engine on the grade, after having fixed a broken air hose.

10 These facts prove the statement in Par. 52 that, due to extreme power in running slow, the starting is affected without jerks and shocks, making it less destructive on cars and couplers than with much lighter ordinary engines that always have to jerk their trains into motion, utilizing whatever slack can be had in couplers.

THE SURGE TANK IN WATER POWER PLANTS

By Raymond D. Johnson, Published in June (1908) Proceedings

ADDITION TO AUTHOR'S CLOSURE

20 Time has been found for a careful study of the error in Equation 7 as indicated by Mr. Larner's figures, Table 2. The error made by substituting V'_{max} for V_2 in Equation 7 cannot be correctly expressed by a single figure, because one assumes, in an actual case, all the conditions except the value of R, which is computed from the other accepted figures. Both V'_{max} and Y_{max} are therefore assumed, as well as the intended per cent load change.

21 As a matter of fact, the value of R thus deduced is never such as to permit a realization of the accepted Y_{max} simultaneously with the corresponding value assumed for V'_{max}. In other words, when V' actually reaches a value equal to that predetermined as a maximum, a certain small excess load above that contemplated must have been demanded, as shown in Column 1 in the table herewith. (The assumed load change has been reduced to 10 per cent in all cases, for ease of comparison.) The value of Y_{max} existing at that time would, however, be a little *less* than the intended value, so that, if an extraordinary load, greater even than shown in Column 1, should be demanded, thus incidentally *increasing* the value of V'_{max} *above the estimated figure*, the tank would still be large enough to permit a load change equal to that shown in Column 2, in which case the tank would theoretically become empty.

22 Inasmuch as the value fixed for V'_{max} is very important (because it is a rough index of the *length of life* of the wave) one is led to regard the values in Column 1 as more properly expressing the capacity of the tank than the values in Column 2. It is apparent, at any rate, that two values are required for a full appreciation of the amount of excess which is provided. The figures indicate the percentage of increase above the *existing load*, as compared, in all cases, with an estimated 10 per cent increment. The table is made up by faithful adherence to Mr. Larner's figures.

23 Example 12 seems to be an illustration of an augmenting wave, and if so, the tabulated errors are naturally meaningless. I have, therefore, been obliged to omit it as valueless in this connection.

24 It has been my experience that any error creeping in through the arithmetic integration is often on the *unsafe side*, and hence one may expect that in some instances, at least, the tabulated excess is greater than that actually provided by Equation 7. I am led to question the usefulness of the values given by Mr. Larner in the last examples because an inspection of the various quantities which he has worked out indicates that the design provided by them would be inadequate on account of a very long-lived wave.

TABLE 4 LOCAL CHANGES PROVIDED BY EQUATION 7

COMPARED WITH AN ESTIMATED 10 PER CENT CHANGE FOR MR. LARNER'S 15 EXAMPLES

EXAMPLE NO.	COLUMN 1	COLUMN 2
1	10.86	12.42 (?)
2	10.71	11.53
3	10.10	10.42
4	10.20	10.86
5	10.41	11.25
6	10.28	11.05
7	10.30	10.92
8	10.27	10.73
9	10.20	10.72
10	11.62 (?)	13.10 (?)
11	10.08	10.74
13	10.72	11.76
14	11.83 (?)	13.00 (?)
15	12.00 (?)	12.81 (?)

SAFETY VALVE DISCUSSION

CONTINUED FROM THE FEBRUARY MEETING

Prof. F. L. Pryor. The results secured from tests made by the writer some time ago, in conjunction with Professor Jacobus, to obtain the blowing-off pressure of safety valves when tested with water and with steam, may be interesting to the Society.

2 For the purpose of the determination, a standard 4-in. pop safety valve, set for 125 lb., was mounted on a 4-in. pipe and so connected that either steam pressure or water pressure could be admitted to the valve. In all the tests the pressure required to open the valve was determined by subjecting it alternately to steam and water pressure, the setting of the valve being the same for the steam and the water in each pair of tests. The water was at a temperature of 100 deg. fahr.

3 One set of tests was made over a period of 15 days, the test of one day being with steam and the following day with water, and so on until the series was completed. The lapse of time between tests was allowed to insure that the valve had obtained its normal condition of temperature, etc.

4 In a second series of tests the valve was tested at three different settings on the same day, viz. 104, 131 and 159 lb., the spring and valve being, in each case, cooled in cold water before taking the measurement for the water-pressure test.

5 The third series of tests was made with the valve at a number of different settings, from 105 to 165 lb., one measurement being made directly after the other and no precaution taken to insure that the valve had returned to its normal temperature after the preceding test, except that before operating with water pressure a considerable amount of water was flushed through the valve.

6 The results obtained in all the tests were in practical agreement, and indicated that the blowing-off pressure with steam and with water did not differ to any great extent, although the pressure to blow off with water was higher than with steam.

7 In the case when the valve was allowed to cool 24 hours, the water pressure required to open it was about 3½ lb. higher than the

steam pressure. In the tests where the valve was cooled thoroughly with water, the pressure with water was about 3 lb. higher than with steam. In the rapid change test the water pressure amounted to about 2.6 lb. more than the steam pressure.

8 In all tests the steam and water pressure record was that at which the valve was in full operation. In the case of the steam pressure test there were two distinct points below full open pressure which could also have been noted: when the valve began to leak, which occurred about 2 lb. below the final blowing-off pressure, and when the rate of flow suddenly increased, which was about 1 lb. below maximum.

Prof. Edw. F. Miller. The weight of steam to be discharged through a locomotive safety valve need be only a small proportion of the steam generated by the boiler, as Mr. Whyte has said. In the case of stationary boilers, however, the safety valves must be able to take care of the entire capacity of the boiler. The sudden closing of the safety throttle on an engine or a turbine by instantly stopping the demand for steam compels the safety valves to discharge for a time at least as much steam as the boilers were generating at the instant the throttle closed. The writer has seen the pressure go up on account of insufficient safety valve discharge, 15 lb. above the blowing pressure of the valves.

2 The writer believes that the correct way to figure a safety valve is to make the discharge area of the valve or valves sufficient to handle all the steam the boiler can make at its maximum rate of coal consumption; which amounts to making the size of the safety valve depend on the grate area, the weight of coal burned per square foot of grate per hour and the evaporation per pound of coal burned.

3 The weight of steam flowing through an orifice with a slightly rounded entrance may be figured quite accurately by Napier's formula (sometimes called Rankine's formula). Its accuracy for commercially dry steam has been shown by tests made under pressures varying from 30 to 150 lb. There are a number of papers on this subject in the earlier volumes of the Transactions. According to the formula the weight of steam discharged per second through an orifice with slightly rounded entrance is $\frac{F\,P}{70}$, where F is the area of the orifice in square inches and P is the pressure in pounds absolute on one square inch.

4 The discharge per second through an orifice with sharp edge at entrance, as would be the case in a safety valve, has been found from actual tests on values to be 0.95 the amount figured from this formula.

5 The opening needed in a safety valve may be figured as follows:

G = grate area.
R = rate of coal consumption per square foot of grate per hour.
9 = probable evaporation per pound of coal under actual conditions.

$$\frac{G \times R \times 9}{3600} = \text{weight of steam made per second.}$$

Equate this to the preceding expression and solve for F:

$$\frac{G \times R \times 9}{3600} = 0.95 \, \frac{F \times P}{70}$$

$$F = \frac{G \times R \times 9 \times 70}{3600 \times P \times 0.95}$$

6 The area of the opening through a safety valve is equal to the inner circumference of the seat times the effective lift. For a valve with seat at an angle the effective lift is equal to the lift multiplied by the cosine of the angle the seat makes with a horizontal.

7 For a 45-deg. angle the effective lift is 0.707 × lift. Calling D the inner diameter of the valve, the opening is

$$\pi \times D \times \text{lift} \times 0.707$$

Substituting this for F,

$$\pi D \times \text{lift} \times 0.707 = \frac{G \times R \times 9 \times 70}{3600 \times P \times 0.95}$$

If the lift of the valve is $\frac{1}{10}$ in.,

$$D = \frac{G \times R \times 9 \times 70}{3600 \times P \times 0.95 \times \pi \times 0.707 \times 0.1} = \frac{G\,R}{P \times 1.206}$$

If the lift is 0.05 instead of 0.10, then the value dia. D is doubled. Doubling the pressure will make the same valve with same lift take care of double the weight of steam.

8 For illustration:

Grate area = 25.
Coal consumption = 18 lb. per square foot hour.
Pressure = 120 lb. absolute.

$$D = \frac{25 \times 18}{120 \times 1.206} = 3.1$$

Pressure, 150 lb. absolute.
Grate area, 50 sq. ft.
Coal consumption, 25 lb. per square foot hour.

$$\frac{50 \times 25}{150 \times 1.206} = D = 6.9 \text{ in.}$$

A valve as large as this would be replaced by two of equivalent capacity.

The circumference = 3.14 × 6.9

Two smaller valves of diameter $\frac{6.9}{2} = 3.45$ will give the same circumference and the same discharge with the same lift.

George H. Musgrave[1] I have been asked to give my experience in the development and use of safety valves, which dates back over a period of about 30 years.

2 Commencing in locomotive service, we used the weight and lever type; but in lieu of the weight, we employed a spring balance at the end of the lever. This served its purpose very well, but left it optional with the engineer to carry pressure in excess of that allowed. To keep tab on excess pressure a téll-tale steam gage was used with an index hand which moved to the highest pressure reached by the steam-gage pointer and remained at this point. When the engine returned we could tell by that means whether the engineer carried more pressure than allowed.

3 The first pop valve that I had experience with was the Richardson open-type, exposed-spring, with two vertical studs and a crossbar on top, and the spindle extending two-thirds of the way through the body of the valve below the seat. The diameter at the bore was 2¼ in.; the first known so-called high-lift pop safety valve.

[1]General Sales Agent, Star Brass Manufacturing Co., Boston, Mass.

4 In the discussion at the February meeting on the desirability of so-called high-lift and low-lift safety valves, Mr. Darling described methods of testing valves and showed designs of valves with which results were obtained, which had been known for years to the older manufacturers of safety valves. I refer to this merely to explain the difficulty we experienced with the Richardson type 2½-in. bore. The lift of this valve was sufficient at times to raise the water from its normal condition, disturb materially its level in the boiler and, on numerous occasions when the engine was working steam, to take it over in the dry pipe and down to the cylinders.

5 The Richardson valve could not be regulated easily to reduce the steam pressure a given amount. Much depended on the accuracy of the springs, consequently the amount of blow-down would vary anywhere from 5-lb. to 15-lb. gage pressure. The adjusting ring was then applied, enabling us to overcome some of these difficulties by increasing or decreasing the area of the safety valve pop chamber.

6 On account of the excessive discharge of this type of valve and the noise of the steam blowing into the atmosphere, because of the high lift, some of the Eastern states passed laws prohibiting the excessive blowing, on the ground that it was detrimental to the community at large. Many accidents occurred because of the noise of the escaping steam; consequently the muffled valve came into general use.

7 This type of safety valve was larger in diameter than the Richardson, and varied from the original size of 2½-in. bore up to and including 4½-in. bore. Being larger in diameter, with steam muffled so that it made less noise, it proved very satisfactory.

8 Mr. Darling refers to the most severe test on locomotive safety valves as being when an engine ascends a grade with the boiler full of water and working hard. A competent engineer fills his boiler before reaching the hill and climbs the grade with the least amount of water in the boiler necessary for safety, thereby keeping up the steam pressure. When he reaches the apex of the grade and starts down the other side, he will then apply his injector and the fireman will attend to the dampers and check the drafts.

9 The most severe test on locomotive safety valves, I think, is when an engineer is running at full speed, with a good fire, steaming rapidly, and is suddenly confronted with a danger signal, which causes him to stop, perhaps within the length of his train. The draft from the exhaust is shut off, but the steaming capacity of the boiler is not shut off proportionately at that time and the valves

almost immediately start blowing. Then the fireman should attend to his dampers and in other ways prevent excessive blowing.

10 There are several methods by which safety valves can be operated without excessive blowing, on stationary and marine as well as on locomotive boilers; although there is more blowing of steam on the latter than on any other type. In marine service the blowing of safety valves is the exception, and not the rule. They carry this still further in the Navy, and I am informed by competent naval engineers that the engineer on watch on a naval vessel is reprimanded if the safety valves blow.

11 The function of the safety valve is two-fold: (*a*) it gives notice of the highest pressure permissible; (*b*) it gives the alarm that more water or less fuel is needed. The experienced engineer and fireman, by working in harmony, can decrease the blowing of safety valves to a very appreciable extent. I have been told by engineers in the marine service, that through the use of safety valves with excessive lift and quick discharge, their engines have been plugged by taking over water. I have known of numerous occasions in locomotive service where there have been very disastrous results. If the same principle is to be introduced in high-lift locomotive safety valves that is now used in injectors to raise water, what is to prevent the syphoning of the water to the throttle valve, and its flowing through the dry pipe and into the cylinders? From my long experience, originally in locomotive service, afterwards in marine and stationary service and at the present time, on safety valves for all uses, I would suggest that the medium-discharge valve, that will not materially disturb the water-levels in the boilers, is the safest and most satisfactory valve to use. Any valve that will materially disturb the water-level and have a tendency to raise it, is dangerous.

12 It has been argued by some of the discussors that it was necessary to know the capacity of different size safety valves. This is a matter for the engineering fraternity, not for the manufacturer to decide. Most manufacturers can comply with the requirements of the engineer as to the efficiency of safety valves, and the amount of steam they will discharge at a given pressure per minute. This can be easily determined, but the engineer should state under what conditions this capacity is required,—whether natural, forced draft, or overload.

13 Mr. Darling's paper describes the tests made by a certain manufacturer, of a number of different types of safety valves made

by other manufacturers. It seems to me that if the Society is desirous of determining the best formulæ from which safety valve sizes can be figured, as well as the best rule for proportioning safety valve sizes to boilers of different kinds, and especially to those of the watertube and Scotch type under varying conditions, it would be best to have the tests made by a competent Board, the members of which should not be interested directly or indirectly in the manufacture of any one type of safety valve.

A. B. Carhart. The proper rating of safety valves and their relation to boiler capacity require simply the determination of the capacity of the valve to discharge steam, and that of the boiler to generate steam, and the fixing of a suitable relationship between the two. Napier's formula for flow of steam has been repeatedly verified by careful tests until it seems worthy of acceptance for valve calculations.

2 For valves of different designs, different percentages of the calculated discharge may be assumed according to the restriction of steam flow by discharge passages. In Steam Boilers, by Peabody and Miller, we find the statement that a 2-in. pop safety valve tested at the Massachusetts Institute of Technology was found to lift from 0.07 in. to 0.08 in. The valve had a conical seat with an angle of 45 deg. The actual flow was about 95 per cent of the calculated flow. The large discharge efficiency of this valve is probably due to the peculiar form of its lips which utilize to the greatest degree the impact force of the steam flow; and to the fact that the regulating ring is entirely below the edge of the lip, with additional vents which add to rather than decrease the outlet opening when the valve begins to blow.

3 The effective opening in a bevel-seated valve is approximately $\frac{7}{10}$ of the vertical lift of the disc. In some valves, however, the design is such as to reduce this area of flow beyond the valve seat, and allowance for this limitation of discharge area, less than the valve-seat opening, should be made. In the patent issued to Richardson, the inventor of a still common form of bevel-seated pop valve, January 19, 1869, the following reference is made to this point:

The said means, so patented, consisting in forming the valve with a surface outside of the ground joint for the escaping steam to act against; the said surface being surrounded by a projecting or overlapping lip, rim or flange, leaving a narrow space for the escape of the steam when the valve is opened, but which, al-

though of greater diameter than the valve seat, by reason of the said lap, presents a less area of opening for the escape of steam than is produced at the valve seat.

4 The amount of the overlap of the lip of the regulating ring is often as much as 0.02 in. or 0.03 in., which the disc must lift before there is a free outlet, and the passage to the open air may easily be 15 per cent or 20 per cent less than the apparent calculated lift would indicate, even after allowing for $\frac{7}{10}$ of the vertical measurement.

5 The satisfactory behavior of the valve depends upon the intelligent adjustment of its regulating device to suit peculiar boiler conditions. Attention was called to this in the report of the Special Committee of Supervising Inspectors, in 1875, p. 30. Valves were submitted for testing, which had previously been adjusted, in most cases to boilers which furnished but a small volume of steam, but when the competitive tests were made the valves were found to need readjusting, since the volume of steam furnished was equal to or beyond the capacity of the valves.

6 This same committee also made a series of tests on several sizes of common ball and lever safety valves of the old type, on page 21 of the pamphlet, to the effect that:

The maximum areas obtained were a little in excess of the above (average), but it must be kept in mind that the boiler evaporated at the rate of 2500+ lb. of water per hour some portion of the time;

Also, that the diameter of a safety valve is not an infallible test of its efficiency;

That the lift which can be obtained on a safety valve, other conditions being equal, is a test of its efficiency;

That the lift of a safety valve depends upon the velocity and weight of the escaping steam;

That the valves with small areas made a greater excess than those with large areas, even when the former recorded a greater maximum of effective area;

That the common lever safety valve, when constructed upon correct principles, employing good material and workmanship, will correctly indicate the maximum pressure of steam in a boiler, and, when suitably proportioned, relieve the same of all excess.

7 The excess referred to means "the number of pounds which the valves allowed the pressure to exceed that at which they opened." If these comments by the committee have any proper bearing upon the present question of pop valves at all, the meaning is plain that small valves of high lift have less discharge capacity for equal areas of effective opening than valves of larger diameter with moderate lift; and that valves of very small lift give proper relief if suitably proportioned to the boiler capacity.

8 One danger to be guarded against is the failure of the valve to open at the critical moment. The greatest cause of sticking is the binding friction of the disc guides against the side of the throat. With large lift the deformation of the spring is great, with resultant side thrust on the guide wings, which have been known to wear $\frac{1}{8}$ in. in diameter in a few months' service. Under such conditions the valve disc will not seat properly and cannot as certainly be relied upon to open and close promptly or keep tight. Hence a small valve with large lift is not the equivalent of a large valve with larger diameter, requiring less lift to give the same discharge.

9 For locomotive valves, where the steaming capacity of the boiler is large, the steam is freely discharged, and the valves are subjected to inspection, the vertical lift may properly be as much as 0.07 in. or 0.08 in., but it should not be more at such high working pressures, with frequent blowing. For stationary valves it should not exceed 0.1 in. and may well be as much less as the conditions will permit. Considerations of stability and safety suggest to conservative engineers that the amount of lift be reduced rather than increased.

10 The lift of any valve can be varied considerably at will. Without any alteration of design or parts it may be made 0.04 in. as the minimum or 0.1 in. as the maximum by a single turn of the regulating ring; and to meet extreme demands these limits can be extended by a simple substitution of another spring, without changing any of the working parts of the valve. That valve which affords relief with the least lift of the disc, or with least spring distortion, and with the least strain upon the boiler, is the safest and most efficient in design.

11 For stationary boilers, generally used at the lower pressures, 5 in. diameter of valve seat should be the limit, and this is the largest valve permitted by law in Massachusetts. The rules of the steamboat inspection service provide that no valve shall be larger than 6 in. in diameter, and they seem to have seriously considered reducing this limit to $4\frac{1}{2}$ in. That supervising engineers seldom specify valves larger than 5 in. diameter is a fair indication that such practice is within good judgment, and some manufacturers do not list larger sizes as regular. In some jurisdictions, where the rules have been recently revised, a 4-in. limit has been fixed.

12 Pop safety valves for locomotives should not be larger than $3\frac{1}{2}$ in. diameter at the seat, as at 200 lb. pressure the total load upon the valve disc in the bevel-seated valve is then 1925 lb.,

increased perhaps 500 lb. to maintain the lift when the valve opens, a total of 2400 lb. This means an enormous force to be controlled even at moderate lifts. In the flat-seated annular valve this initial load is only 1575 lb., increased to about 1800 lb. when the valve lifts, since the possible maximum is under all conditions less than the initial or minimum load upon the bevel-seated valve; although the effective discharge area in the 3½-in. size, with the proper 15 per cent allowance for the central auxiliary outlet, amounts to little more than 1 sq. in. at only 0.08 in. lift of the disc, or something over 3 lb. of steam per second, according to Napier's formula. This area of discharge opening is equivalent to a vertical lift of 0.128 in. in a 3½-in. bevel-seated valve of 100 per cent theoretical discharge efficiency.

13 The capacity would be proportionately increased in a 4-in. valve, but as all the parts would become unwieldy in weight and size, there seems to be no good reason for opening up such a large hole in the boiler, with a seat circumference of 12½ in., requiring a valve weighing something over 75 lb. Certainly the 4-in. size is the extreme that can be recommended, even taking into account any difference in cost. In the bevel-seated type a 4-in. locomotive valve of theoretical efficiency should lift 0.113 in. to show 1 sq. in. discharge opening, and might better be divided into smaller units, considering that the initial spring load in such a valve is over 2500 lb. and when the valve opens may exceed 3000 lb. to react through this distance.

14 Experience indicates an effective area of 1 sq. in. as the largest unit of valve capacity advisable for large boilers of the steaming capacity of modern locomotives. The strain upon the boiler is dangerous when a large valve is suddenly opened at high pressure and as suddenly closed. Water may be drawn out of the boiler with the steam, the surging and priming endanger the cylinders and choke the safety valve, and boiler-scale deposits cut the seats and cover exposed threads. Much better practice is that more commonly followed, using three valves of comparatively small size, set to open 2 lb. or 4 lb. apart, and called into operation in succession as the steaming conditions require. This prevents serious rise in boiler pressure before relief.

15 From careful observation, we know that in actual service two 3½-in. or three 3-in. flat-seated valves, even when regulated to permit a comparatively limited vertical lift, have proved ample for the largest locomotive boilers under the most severe requirements

of heavy steaming and freight service on mountain railroads, and under such circumstances the third of a series of three 3-in. valves has never been known to blow; while records show that on many locomotives the pressure has never increased sufficiently to reach the second valve, set at 2 lb. or 4 lb. above the first. The effective discharge area of a 3-in. annular flat-seated valve, with a maximum lift of 0.08 in., is a little more than 0.85 sq. in., and is capable of discharging 2½ lb. of steam per second at 200 lb. pressure, so that the greatest combined capacity of the three 3-in. valves would be about 7½ lb. of steam per second.

16 Mr. Whyte is thus correct in saying that safety valves need not have a discharge capacity equal to the steam-generating capacity of the locomotive boiler under forced draft. Experience has demonstrated a total valve capacity theoretically equal to 2 sq. in. discharge area as safe and efficient for ordinary locomotives with 35 sq. ft. of grate area, and 3 sq. in. for the largest ones, having as much as 50 sq. ft. of grate area, and not more than two-thirds of even this provision has ever been called into service. To provide greater capacity than is required means either multiplication of valves or increased capacity in each unit, regardless of certainty of operation and freedom from repairs.

17 A satisfactory solution of this whole question seems to be to equip a locomotive with three valves, each of 3-in. or 3½-in. diameter, in proportion to the capacity of the boiler, as follows:

- *a* A muffled valve seat at 200 lb., permitting only 3 lb. or 5 lb. drop in steam pressure when it opens, to act as a working value for all ordinary running conditions, leaving the locomotive with proper pressure to continue its work after the blowing of the valve.
- *b* A reserve valve of the same type, set at 202 lb. or 204 lb., to take care of unusual conditions under which the steam pressure might possibly continue to rise in spite of the first valve, and regulated to permit a drop of 5 lb. or 6 lb., not letting the pressure go much below the normal 200 lb.
- *c* An emergency valve, of the same type but different proportions of disc, and with an extremely resilient spring, to open at 206 lb., with an adjustment set to insure an exaggerated lift and large discharge that will cause the boiler pressure to drop 15 lb. or 20 lb., practically putting the locomotive out of service until this drop in pressure

can be regained. The blowing of such a valve, on rare occasions, would indicate an extreme condition calling for immediate attention from engineer, fireman, and conductor.

18 To distinguish these valves in service, some difference in design or marking might be established, or the working valves might be muffled and the emergency valve be of the open type.

19 The common practice has been to design and regulate locomotive valves to cause the steam pressure to drop 3 lb. or 5 lb. below the opening point before closing, and the regulating ring or device would be set at the time of testing to accomplish this with a period of blowing that would cause the least shock to the boiler with efficient relief. The greatest difficulty that valve makers meet today is not the simple problem in mechanical design of building safety valves with large discharges or lifts, but in educating and persuading operating engineers actually to utilize the valves to their intended normal capacity, instead of resetting the regulating adjustment so as to throttle the valve action beyond reasonable limits, to prevent what they regard as waste of steam when the valve does open in the performance of its proper function. It is not reasonable to expect a valve, designed and regulated to lose 5 lb. in boiler pressure, to perform equally well when the regulating device is adjusted so that the pressure is allowed to drop only 1 lb. or 2 lb., as is actually the condition on many railroads today. Engineers should not complain of a lack of valve capacity so much as of their own blindness in throttling the valves they already have.

20 In small valves, too great lift of the disc gives a discharge area through the seat too large in proportion to the disc area or the diameter of the boiler connection. This is the chief cause of the chattering, exhibited in some valves, involving the destructive hammering of the seat and an inefficient, spasmodic steam discharge. Mounting large valves upon long pipes of small diameter or with bends or elbows, instead of connecting them directly upon the boiler, will develop similar unsatisfactory conditions, if the flow of discharging steam is not sufficiently re-inforced in proper volume from below. It is not enough merely to blow out the steam in the throat of the valve; conditions down inside the boiler must be relieved without undue strain.

Sidney B. Paine said, the question is a great deal broader than that of lift. We do not know today whether a 4-in. safety valve

is capable of relieving a 100-h.p. boiler or a 400-h.p. boiler: the rules of the Steamboat Inspection Service, the Massachusetts and the Philadelphia rules, are all based on diameter without taking into account the lift of the valve-seat, and hence are erroneous. No man could go into court and swear that he knows that the commercial safety valve he has bought will take away all the steam which the boiler would generate with the other outlets closed. This matter of a standard of measure by which valves may be rated is one of the most important that has come before the Society for a long time.

M. W. Sewall. It has been suggested that investigations be made by the government and by boiler insurance companies in order to insure public safety by formulating exact regulations for the proportions of valves, the lift, etc. These suggestions are in the line of tying all manufacturers down to exact rules which would standardize the output along rigid lines, a condition that seems very undesirable. Manufacturers should be allowed the largest liberty in design. The public authorities and insurance companies should, it seems to the writer, establish means of regulation in regard to the following:

a Flange diameters for various rates of discharge.

b Requirements as to minimum discharge of pounds of steam per second within given ranges of pressure.

c Requirements as to non-corrosive seats or other operating parts, strength of parts, means of operation by hand, and security against being put out of adjustment by ill-disposed persons.

2 Whatever importance other matters may have to manufacturers and designers they are not of interest to the public. It would perhaps be desirable to have formulated by them the details of a form of valve that would be acceptable to the insurance companies and other authorities, so that all manufacturers would know of an acceptable form.

3 All details of design, however, and especially such items as form of seats, springs, lift of valves, etc., should be subject to the most liberal treatment. If variety of design is allowed there will be that incentive to develop different forms and types that is requisite to the development of the best methods and designs.

Albert C. Ashton. I am in accord with those who think the Society could profitably investigate the practice among steam-users and formulate for general use a rule giving the proper size of pop safety valves for boilers, taking as a basis the average efficiency obtained from the present standard makes.

2 After a practical experience of over twenty years, I am opposed to high-lift valves, since they open and close so suddenly as to injure the boiler and its connected fittings, as well as the valve itself. Such valves were tried out many years ago and have been discarded.

3 I am satisfied that any revised rule for the size of pop safety valves should not prescribe a capacity of relief that could be obtained only with a high-lift valve, as suggested in the contributions by Mr. Darling and Mr. Lufkin, wherein they approve of a lift equal to $\frac{1}{32}$ of the diameter of the valve. This is excessive, and so far as I have heard has been approved by only one valve manufacturer.

4 In my opinion, it would not be taking a step in advance to require higher-lift valves than those now in common practice. In evidence of this, from my own observation, pop safety-valve manufacturers have experienced more trouble from their standard valves giving too great rather than too small a relief. It is an exception to criticise a reliable make of valve in good working order on account of deficient relief, and even then the fault can generally be attributed to the application of too small a valve.

5 It would be desirable for engineers to specify the required relief, but I think it is not necessary or advisable to specify the lift, for on many applications high-lift valves are not at all suitable.

Mr. A. F. Nagle. I have computed the table herewith upon the size of safety valves for boilers of a given power, based upon the following data:

a A boiler horse-power is the term used to express the evaporation of 34.50 lb. of water per hr. from and at 212 deg. Fahr.

b A spring safety valve can and should be depended upon to lift $\frac{1}{32}$ of its diameter.

c The flow of steam follows closely Napier's formula, reduced to 92½ per cent by Mr. Darling's experiments (par. 24).

d The formula used in the computation is

$$\text{h. p.} = 0.0951\, D^2\, P$$

where

h. p. = boiler horse-power.
D = diameter of valve in inches.
P = absolute steam pressure.

2 In using this table, allowance must be made for what is likely to be the maximum horse-power of the boiler and not its normal rating. Fifty per cent overload is not unusual, and double the rating, while not impossible, is not liable to pass through the safety valve.

HORSEPOWER OF BOILERS AND SIZE OF SAFETY VALVES

Steam Pressure Pounds	Safety Valves					
	2 in.	2½ in.	3 in.	3½ in.	4 in.	4½ in.
100	44	68	98	134	175	221
125	53	83	120	163	213	269
150	63	98	141	192	251	318
175	72	113	162	221	289	366
200	82	128	184	250	327	414
225	91	142	205	280	365	462
250	100	157	227	309	403	510

Note.—Roughly every 4 lb. of coal burned per hour represents one boiler h. p.

Jerome J. Aull. The opening paper on the subject of safety valves was intended, apparently, for the purpose of giving a certain manufacturer of high-lift valves a chance to exploit his product. This conclusion is evident from a number of rather mysterious references such as "The elaborate tests which have already been made—data from which it is hoped may be presented in the discussion of this paper"—and "This is considered an appropriate time and place to make available such information as those who have it may wish to present."

2 It is to be regretted that the evidence of selfish commercialism is so apparent, since it lessens the importance of the deductions resulting from the "experiments" which were made. They do not bear the stamp of approval of disinterested investigators, hence, from a universal point of view, are of little value.

3 In my opinion the proposed rule should include a term for a fixed lift rather than a variable one, for the reason that with the latter would result a hopeless confusion of safety-valve openings in

boilers of the same size. Thus under Mr. Darling's rule a boiler of a certain size might be provided with a safety-valve connection varying from 2½ in. to 4 in. in diameter, depending upon the make of valve specified. It would be far more convenient and satisfactory to standardize safety-valve connections so that any valve having the required capacity could be used. To do this it would be necessary that the valves themselves be standardized within certain set limits, and this could be done only by a body of disinterested engineers, properly authorized to investigate the subject.

4 The proper lift is a more or less debatable question, but it is reasonable to suppose that the average practice of the leading manufacturers, disregarding the minimum and maximum, is very nearly correct. High-lift valves are no improvement nor are they necessary for general purposes. If they were, the standard designs could be very easily altered by manufacturers.

5 If the lift is too high the seats and spring-bearings are subject to a severe pounding action; there is more danger of chattering; close adjustment is not possible; there is danger of lifting of water; and the boiler seams are sometimes strained to the opening point.

6 Having determined the proper lift, it becomes a very simple matter to formulate the rule governing safety-valve discharge areas or seat-opening diameters. The only thing remaining would then be to determine what variation there should be in valve sizes to suit various pressures.

A. J. Hewlings. It is a question whether the amended formula of the United States Steamboat Inspection Service has any advantage over the former rule based on square inches of valve area to square feet of grate surface, because of the alleged extreme variations in the capacities of the different types of valves of equivalent list or catalogue sizes, all of which will be passed by the inspectors.

2 To overcome this condition on the basis of a proposed amended formula, each manufacturer would be required to furnish a detailed schedule of capacities of each size and style of valve under different pressures of steam. In furnishing such a schedule, all tests must be made under exactly similar conditions, with the same boiler, of ample capacity so that fixed time-periods of blowing-off can be accomplished while the boiler maintains a continuously even pressure. In no case should the boiler pressure go low enough to permit the valve to close itself.

3 A question arises as to the reason for the creation of high and low lift valves and whether it is not in most instances by accident rather than design. The assumption is that manufacturers, in designing their own particular style of valve and embodying therein the essential features of mechanism, have produced varying designs and dimensions of projecting discs and regulating rings, which, together with varying types of springs, are principally accountable for the distinction between high and low lift valves and the great differences in capacity of corresponding catalogue sizes. For these obvious reasons it does not seem possible to formulate any definite rule that could be put into general practice while there are so many variations in design.

4 A reasonably consistent solution of this problem might be reached, however, by the adoption of a general ruling requiring that all makes of valves, regardless of design, shall be so proportioned that the steam or self-lifting features shall conform to uniform discharging capacities for catalogue sizes. In this event, it would probably be sufficient that listed capacities of each catalogue size be based on a single given pressure of steam, assuming that different pressures would proportionately give uniform capacities, varying of course as the pressure varies, but in direct ratio with the different pressures of steam. This method would practically accomplish the desired results and conform to the present amended formula of the Steamboat Inspection Service.

AUTHORS' CLOSURES

F. M. Whyte. It appears to me that the discussion of this subject has been very profitable, both to those who have considered it seriously, with the desire to profit by it, and to those few who have treated it with asperity.

2 It has been made apparent that there is much to be learned on the subject, and it is plain that some are endeavoring to add to the present knowledge concerning safety valves; those few who have attempted to discredit the efforts being made to increase our knowledge on the subject, and the spreading of such new data, will, no doubt, profit most by the discussion, providing their future efforts are better advised than was their discussion of the subject.

3 The object of presenting the subject was to have put on record as much information about safety valves as might be possible, to

urge the necessity of future investigations, and if possible to give them direction. It is very evident that the object will be fulfilled.

Philip G. Darling. Many different values for safety-valve lifts are at present being advocated, together with arguments why each is the highest safe or advisable value for general use. Recent articles place this maximum limit variously at 0.05 in., 0.06 in., 0.08 in., 0.09 in., and 0.14 in., for the same size valves. The diversity of these values raises the question as to what is the basis in setting such limits, and whether there are any inherent elements or principles of design calling for this restriction.

2 It is well known by those in touch with foreign manufacturers that valve lifts, spring compressions and other valve elements are being successfully, and in places universally used, which are radically different from what has been the general practice in this country.

3 Two cases will illustrate this. The springs on 3¾-in. triplex valves of the Thornycroft design, used widely in English marine practice, are not only of the exposed type, but have, when set for a designed pressure of 250 lb., a compression of 4 in. These are regular safety valves of the same principles as our own duplex valves. To those who would condemn a compression of ½ in. to ⅝ in. as radically high and unsafe this instance should be suggestive and help to broaden their conceptions of the possibilities of safety-valve design. Again, in *London Engineering*, February 26, 1909, reprinted in *Power*, March 30, 1909, J. H. Gibson tells of exceptionally good results obtained in a valve having 0.21-in. lift. He says: "We think we are justified in the assumption . . . . that anything tending to reduce the size of these important fittings (safety valves), which have been growing to abnormal proportions of late, is a step in the right direction."

4 These two illustrations indicate very clearly that in England no inherent valve conditions have been discovered limiting spring compressions to ½ in. or valve lifts to 0.05 in. and 0.08 in. Nor in fact are such arbitrary limits actually restricting the progress of design in this country.

5 High lift is not synonymous with excess safety-valve capacity. A boiler's evaporation absolutely determines the necessary safety-valve capacity. In a given boiler the pounds of steam per hour which the valve should be able to relieve can be definitely figured and all that is further needed, in making the correct valve specification, is the capacity of the safety valves.

6 It is not a question of lift for itself, but of requisite relieving capacity, and if this is obtained with a 3-in. instead of a 4-in. or 4½-in. valve there is a positive, real advantage, not only in original cost but in the maintenance and better action of comparatively small rather than large valves.

7 High or low lift is a question of personal preference on the part of the buyer, a question of legitimate argument for and against on the part of the seller. It is probably better for the progress of safety-valve design that manufacturers should *not* agree, that buyers should have a preference to draw from, that valves having different lifts should be out in general competitive trial as they are today.

8 It is thus not a uniformity in the lifts of different valves which the engineering public should demand, but rather the practice of stating relieving capacities, based on the actual lifts existing in the valves themselves. The assumption of an average lift in rating capacities of different makes of valves is a method not only liable to such large error as to be entirely inadequate and unsafe, but it must act as a great restriction to progress in valve design. The logical policy is for valve-makers to continue to advocate each his own lifts and capacities for valves, but on the other hand for all to agree and to state, and if desired, to guarantee, what the actual relieving capacities of their valves are. If the capacities were stamped upon the valves, as already done by one maker, it would give a rational basis for use in the application of safety valves to boilers.

9 It has been objected that capacities thus published could not be verified without actual capacity runs, such as the Barberton tests recorded in my paper, on the ground that in some valves the effective area of discharge at the seat, upon which the formula is based, is not the smallest discharge area; or even if it is, that there is a material throttling or holding back of the steam flow. Valves containing the original Richardson adjusting ring have been cited as designs in which this choking occurs.

10 In order to secure information upon this matter prior to conducting the direct-capacity tests at Barberton referred to in my paper, the effective discharge areas at the seat and at the most contracted passage between the lip and adjusting ring were figured and plotted for the different valves tested at different lifts. Further, a 3½-in. valve was constructed having this Richardson ring and projecting disc lip design, and for the same valve another disc and ring in which the projecting lip was cut entirely away. In the former the discharging steam was deflected through practically 90

deg., and in the latter the steam had a free straightaway passage. These two designs were radically different and fairly represented the extremes of what on the one hand seemed to be a choked or impeded steam discharge passage and on the other a free open one.

11 The effective discharge areas of the two taken at the seat and at the most contracted part of the passage between the lip and rings are given in the table in square inches for different lifts.

TABLE 1 EFFECTIVE DISCHARGE AREAS

Valve with projecting lip and Richardson ring			Valve without the lip	
Lift	At seat	Most contracted point beyond seat	At seat	Most contracted point beyond seat
0.02	0.16	1.20	0.16	2.01
0.06	0.47	1.40	0.47	2.14
0.10	0.79	1.76	0.79	2.29
0.14	1.11	2.27	1.11	2.43

These areas, taken with Napier's formula, give a method of figuring the theoretical pressure existing in the "throttling chamber" under the disc-lip; that pressure being to the boiler pressure as the effective discharge area at the seat is to the most contracted area between the lip and ring beyond. The highest pressure thus indicated in the throttling chamber is less than 50 per cent of the corresponding boiler pressure. This pressure in the "throttling chamber" being the discharge pressure of steam passing over the valve seat, and the full flow of Napier's formula being practically unaffected by any discharge pressure less than 60 per cent of the original or boiler pressure, the theoretical conclusion is that the discharge from neither of these valves would be affected by the disc design or discharge areas outside of the valve seat.

12 This preliminary reasoning was corroborated in the direct-capacity tests run at the Stirling Works of the Babcock & Wilcox Company at Barberton, Par. 23, *b*, of my paper. This area between the lip and ring of the regular Richardson ring design was even further contracted by running the adjusting ring up a full additional turn ($\frac{1}{16}$ in.) under the projecting lip as referred to in Par. 23, *c*, and even this did not materially alter the discharge.

13 The conclusion is, that the variations in design of different makes of safety valves, though considerable in appearance, are in

no case of a character to alter the direct relation of lift to capacity, and thus that safety-valve relieving capacities do vary directly with the lift obtained with valves, that there are no exceptions to this as valves are being constructed, and, therefore, that the basis upon which the proposed safety-valve capacity formula has been founded is sound.

14 The discussion has contained references to disastrous results to boilers, such as the opening up of seams and fittings due to the sudden release or cutting off of steam by the safety valve. If such disaster could result from the action of even the largest valves it would be a legitimate argument only against excess valve-capacity and never against a proper application of either high or low lift valves. As bearing on this it should be noted that enginemen generally close the throttle with a single straight push of the lever, giving nearly, if not quite, as sudden a closing as a safety valve. On the larger passenger engines this means the sudden stopping of the steam-flow from the boiler at the rate of 20,000 lb. to 30,000 lb. per hour, which is three or four times as great a steam-flow as through the corresponding "high-lift" safety valve which this locomotive would have. A 3½-in. valve of this type would discharge at the rate of from 8000 lb. to 11,000 lb. an hour, the former at closing, the latter at opening.

15 Locomotives having 3½-in. safety valves will generally have about 2-in. blow-off valves, giving a vent opening of 3.14 sq. in. These valves are placed below the water-level and are generally operated with a straight lever handle or pneumatically, giving an abrupt open and close from full area. Suddenly shutting off a flow of water, which is a comparatively incompressible substance, would seem to be more of a shock than shutting off a similar flow of steam, which is an elastic, compressible substance, forming a perfect cushion. Hence, the shock to the boiler caused by the closing of the safety valve handling steam instead of water, and with but ⅓ to ¼ the area of the blow-off valve, must by conrast be inappreciable. Yet this blow-off arrangement is considered good practice.

16 The larger the safety valve compared with the boiler the greater the shock to the boiler due to its action, if such shock exists. A 5-in. valve mounted directly upon a 94-h.p. test boiler would increase or accentuate this tendency to strain over say a 3½-in. valve on an 800-b.h.p. locomotive surely 12 or 13 times. Yet with a most sensitive boiler pressure test-gage graduated to pounds and mounted upon this 94-h. p. test boiler, absolutely no recoil of

the gage hand upward either at the opening or closing of a 5-in. valve is perceptible. It would seem that some increase of pressure such as would be indicated upon the gage would be positively necessary to transmit a strain to the boiler.

17 Two cases have recently come to my notice in which locomotive safety valves have loosened from their spud connections and have blown off while the boiler was under its full steam pressure. One was a 3½-in. and the other a 4-in. valve, which therefore opened areas of 9.6 and 12.6 sq. in., respectively, while the maximum corresponding safety-valve discharge area could be but a little over one square inch. Yet no damage to the boilers was experienced. The blowing-off of 2-in. locomotive whistle connections has been cited as a not infrequent occurrence. The steam-relief in such accidents is of course more sudden than with a safety valve, and the fact that this opening of ten to twelve times the maximum discharge area of the corresponding safety valves results in no further inconvenience than the replacing of the fittings raises some question as to the actual disaster impending in the use of valves having a discharge area of but 1 sq. in.

ACCESSIONS TO THE LIBRARY

BOOKS

ACCURATE TOOL WORK. By C. L. Goodrich and F. A. Stanley.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS. 33d Annual Catalogue. Gift.

BETA THETA PI. Vol. 36, spec. no. 2. March 1909. Gift.

BOARD OF COMMISSIONERS OF ELECTRICAL SUBWAYS IN THE CITY OF NEW YORK, Vol. 1–2. Gift of H. S. Wynkoop.

CHAMBER OF COMMERCE OF THE STATE OF NEW YORK, APRIL 1909. Bulletin. Gift of J. F. Sorzano.

COMMISSIONER OF EXCISE, STATE OF NEW YORK, 1908. Report. By Maynard N. Clement. *Albany, J. B. Lyon, 1909.* Gift of M. N. Clement.

COMMISSIONER OF NAVIGATION. Annual Report, 1900. Gift.

CONFERENCE OF GOVERNORS, WHITE HOUSE, WASHINGTON, D. C., MAY 13–15, 1908. *Proceedings.* Edited under the direction of N. C. Blanchard, *Chairman*, J. F. Fort, J. C. Cutler, J. P. Davidson, M. F. Ansel, the Committee of Governors. By W J McGee. Gift from the White House.

CONSULTING ENGINEER'S REPORT ON THE WILLCOX AUTOMATIC WATER WEIGHER. (From Power and The Engineer, February 23, 1909.) Gift.

CONTRIBUTIONS TO THE TERTIARY PALEONTOLOGY OF THE PACIFIC COAST. I-Miocene of Astoria and Coos Bay, Oregon. By W. H. Dall. (Professional Paper no. 59, U. S. Geolog. Survey.) Gift.

DESIGN AND CONSTRUCTION OF CAMS. By C. F. Smith, F. A. Halsey and others. *New York, Hill Pub. Co., 1906.* Gift of the Publishers.

ECONOMY FACTOR IN STEAM-POWER PLANTS. By G. W. Hawkins.

FUNDAMENTAL PRINCIPLES OF GAS ENGINES AND GAS PRODUCERS. By R. T. Lozier. (Transactions no. 10, New York Electrical Society, 1906.) Gift.

GAS ANALYST'S MANUAL. By Jacques Abady.

HARVARD COLLEGE. Reports of the President and Treasurer. 1907–1908. Gift.

THE HOUSE-FLY AT THE BAR OF INDICTMENT: GUILTY OR NOT GUILTY? *1909.* Gift of Merchants' Association of New York.

How to Build up Furnace Efficiency. Ed. 3, revised. By J. W. Hays. Gift.

Inland Waterways Commission, Preliminary Report. Gift.

Iowa Electrical Association. *Proceedings of 8th Annual Convention.* Gift.

Legal Aid Society of New York. Thirty-third Annual Report of the President, Treasurer and Attorneys, 1908. Gift.

Lippincott's New Gazetteer. A Complete Pronouncing Gazetteer or Geographical Dictionary of the World. Edited by Angelo and Louis Heilprin.

Massachusetts, Commonwealth of. Rules Formulated by the Board of Boiler Rules. Gift.

Morrison's Spring Tables. By E. R. Morrison.

National Physical Laboratory. Report, 1906. Gift of C. W. Rice.

National Physical Laboratory, Engineering Department. Statement as to Tests and Measurements undertaken in the Department, July 1906. Gift of C. W. Rice.

National Physical Laboratory. Observatory Department. Statement as to Tests undertaken in the Department and Certificates Issued, October 1905. Gift of C. W. Rice.

National Physical Laboratory, Physics Department. Statement as to Tests and Measurements undertaken in the Department, June 1906. Gift of C. W. Rice.

New Dictionary of the Portuguese and English Languages. Ed. 3, 2 volumes.

New English and Italian Pronouncing and Explanatory Dictionary Ed. 8, 2 volumes. By J. Millhouse & F. Bracciforth.

New Method of Gas Manufacture. A paper read by H. I. Lea before the Illinois Gas Association, Chicago, March 17, 1909. Gift.

Notes on Determination of Experimental Equations. (Reprint from The Wisconsin Engineer, December 1908.) By L. F. Harza. Gift.

Ordinance Governing the Department for the Inspection of Steam Boilers and Steam Plants, City of Chicago, May 1903. Gift.

Pocketbook of Mechanical Engineering. Ed. 3. By C. M. Sames.

Pocket-Book of Useful Formulae and Memoranda for Civil, Mechanical and Electrical Engineers. Ed. 26. By G. L. Molesworth.

President of the Borough of Richmond. Annual Report, 1907. Gift of L. L. Tribus.

Railway Shop up to Date. A Reference Book of American Railway Shop Practice.

Recent Researches and Future Work. By R. T. Glazebrook. (National Physical Laboratory.) Gift of C. W. Rice.

Risultati delle Prove di Traizone Eseguite coi Nuovi Tipi Locomotive F. S. (Dicembre 1906 a Giugno 1908.) 2 vols. Gift of Ingegneria Ferroviaria.

Sanitation and Sanitary Engineering. Ed. 2, revised and enlarged. By W. P. Gerhard. *New York, 1909.* Gift of author.

Significance of Drafts in Steam Boiler Practice. (Bulletin no. 367, U. S. Geolog. Survey.) By W. T. Ray and Henry Kreisinger. Gift.

The Steam Turbine. By J. A. Moyer.

Syracuse University. (Bulletin, April 1909.) Gift.

System of Governing and Valve Gears of European Gas Engines. By R. E. Mathot. Gift.

United States Interstate Commerce Commission, Twenty-Second Annual Report. Gift.

University of Illinois, Engineering Experiment Station. (Bulletin.) Vol. 3, no. 18–26. Gift.

Warner's Notes Concerning Non-Parallel Axle Trucks and Bi-Rail Traction. Gift.

EXCHANGES

American Gas Institute. *Proceedings.* Vol. 3, 1908.

International Railway Congress Association. (Bulletin.) General Tables from 1 January, 1896, to 31 December, 1908.

La France Automobile et Aérienne. Year 14, no. 11–date.

Society of Naval Architects and Marine Engineers. *Transactions.* Vol. 16, 1908.

CATALOGUES

American Blower Co., *Detroit, Mich.*

"Sirocco" Blowers. Cuts and description, detail construction of "Sirocco" fans, and their application in trade.

Collins Wireless Telephone Co., *Newark, N. J.*

Collins Wireless Bulletin, *February, 1909.*

Containing: Wireless dirigible airships; Artom directive wireless telegraph system; Wireless electric lights.

Duncan Electric Mfg. Co. (Bulletin No. 8.) *January 1909.*

Direct-Current Integrating Wattmeter. House Type; Model E. Cuts and description of detail construction.

FOSTER ENGINEERING CO., *Newark, N. J.*

Valve installation in the boilers of the Singer Building. Foster Pressure Regulator, cut showing construction.

GENERAL ELECTRIC COMPANY, *Schenectady, N. Y.* Train Lighting with G. E. Tantalum Lamps. (No. 3757.) Tricoat Wires and Cables. N. E. Code Thickness of Insulation. (No. 5196.)

GOLDSCHMIDT THERMIT CO., *90 West St., New York, N. Y.*

Instructions for use of Thermit in Railroad shops.

HARRIMAN BROS., *Boston, Mass.* Description of a Rotary Engine, by J. E. Harriman. (Lecture delivered at the Tech. Union before the Mech. Soc. of Mass. Inst. of Technology.)

A General Report on the Harriman Rotary Engine, by F. C. Morton.

A Report of Economy Tests on the Harriman Rotary Engine, by E. F. Miller.

KERR TURBINE COMPANY, *Wellsville, N. Y.* Kerr Steam Turbine. (Bulletin no. 8, May 1909.)

KEUFFEL AND ESSER COMPANY, *Hoboken, N. J.* Catalogue for 1909.

MANNING, MAXWELL & MOORE, *85–89 Liberty St., New York, N. Y. 1909.*

Catalogue of milling, boring, threading machines, planers, lathes, drills, saws, cranes, grinders, presses, shears, and machine tools.

McNAB & HARLIN MFG. CO., *50–56 John St., New York, N. Y. 1909.* (10th edition.)

Catalogue of iron and brass fittings of every type for steam fitters' use.

MOORE & WHITE CO., *Philadelphia, Pa.*

1903. Price list of coupling, friction clutches, pulleys, shifters, and shafts.

1906. Catalogue of speed changes, cone-pulley transformers, tables of dimensions, one detail drawing and dimensions of the Moore-White Friction Clutch.

NILES-BEMENT-POND COMPANY, *New York, N. Y.* Heavy Milling Machines.

NORTHWESTERN EXPANDED METAL CO., *Chicago, Ill.*

Formulas, diagrams, and data of strength, stresses, and uses of beams and columns in building materials.

UNITED ENGINEERING & FOUNDRY CO., *Pittsburg, Pa., 1908.*

Catalogue of Rolling Mill Machinery, including Shears, Lathes, Accumulators, Cranes, Cars, Gears, etc.

WESTINGHOUSE ELECTRIC & MFG. CO., *Pittsburg, Pa.*

Protective Apparatus for lightning, as lightning arresters, safety spark gaps. Luminous radiators and air heaters.

WILLCOX ENGINEERING CO., *Saginaw, Mich.*

Uses, Construction and Operation of Willcox Water Weigher, Bulletins 3, 4 5, 6.

EMPLOYMENT BULLETIN

The Society has always considered it a special obligation and pleasant duty to be the medium of securing better positions for its members. The Secretary gives this his personal attention and is most anxious to receive requests both for positions and for men available. Notices are not repeated except upon special request. Copy for notices in this Bulletin should be received before the 15th of the month. The list of men available is made up of members of the Society and these are on file, with the names of other good men not members of the Society, who are capable of filling responsible positions. Information will be sent upon application.

POSITIONS AVAILABLE

067 Manager for factory located at Newark-on-Trent, England.

068 Instructor in mechanical and architectural drawing, for Tuesday and Thursday evenings, October to May. Location, Queens Borough, City of New York. Experience in teaching and tact required. Familiarity with manufacturing, drafting room methods essential.

069 Selling engineer wanted for steam condensers. Location, Philadelphia.

070 Wanted, ambitious young man, with selling experience, to represent in Chicago a company manufacturing transmission machinery.

071 Wanted, young technical graduate with good scholastic record and at least two years' practical experience, for position of assistant in laboratory of Engineering School; salary $1000 for academic year. Location, Massachusetts.

072 Man experienced in general machinery; to work on board and handle six men under general instruction of Chief Engineer; experience absolutely essential on jig work and general design. Further, experience in transmission, conveying, gears, etc., preferred; good opportunity for live capable man; give full details of experience, salary expected, and positions previously held, naming employers in first letter; all information held strictly confidential; immediate opening; location, Ohio.

MEN AVAILABLE

254 Member, with fifteen years' experience, an expert on gas engines, gas producers, gas furnaces, gasoline and oil engines, pumping machinery of every description, air compressors, blowing engines, rolling mills, etc., both designer and superintendent, desires change. Now chief engineer of medium-size shop; would prefer larger concern or one willing to take up these branches anew. University graduate, best of references.

255 Manual training and university technical graduate; age 33, thirteen years' practical experience in machine shop, drafting, designing, testing, estimating, etc., has employed and had charge of men; desires position, preferably in Philadelphia, or vicinity. Would consider an opportunity in the commercial line of engineering or manufacturing.

256 Representative of gas power company, desirous of entering into correspondence with a few firms in the machine line in the United States interested in the development of trade in Europe, Asia, and Africa, with view to forming arrangements to represent them.

257 Chief draftsman and designer of special machinery for manufacturing firm. Five years' experience power plant construction, irrigation and general engineering. At present, gas and mechanical engineer for corporation. Executive ability. Position as superintendent of maintenance or construction or as mechanical engineer with contracting or consulting firm.

258 Associate, age 29, technical graduate, two years' experience general drafting, four years of teaching and research in the field of the gas producer, gas engine and steam boiler, capable of directing and handling both mechanical and chemical sides of this line of work, desires position as professor or assistant professor of experimental engineering or as testing engineer in charge of experimental work for a manufacturing plant.

259 Member, long experience in pumping machinery, air compressors, Corliss engines, condensing apparatus; desires position as chief engineer or chief draftsman near New York.

260 Assistant engineer, age 29, Cornell University, M. E., executive and designing ability and good business judgment, ability as investigator and organizer. Broad general experience in mechanical and civil engineering on railroad and car work, steam boilers, gas engines, industrial plant equipment, power house, hydroelectric work, special designs; seeks position as works manager or engineer in moderate-sized progressive concern.

261 Affiliate, and associate member Am. Soc. C. E., eight years' experience on design and construction in steel and reinforced concrete, especially familiar with power-houses and structures for street railway and lighting companies; open for engagement, June first.

262 Junior member, graduate mechanical engineer, seeks position which will offer a future. Three and a half years' general experience as draftsman, steam engineering and special work. Present salary $125 per month.

263 Assisting manager at present engaged with company operating blast furnaces, mines, etc., technical education, familiar with manufacture of merchant pig iron, including Gayley Dry Blast, and all details entering into plant operation; can handle men and produce results.

264 Electrical and mechanical engineer, Cornell graduate, age 32, desires change of position. Practical experience includes power plant and shop superintendence; electric and pneumatic power distribution; applications of electricity

in manufacturing plants, particularly individual motor drive; specification work and correspondence. Broad knowledge of general machinery; executive and business ability; highest endorsements.

265 Member, with business training, going to Europe about the middle of June, would like to act as representative for responsible concern where honesty and integrity are required.

266 Member, 20 years' experience in managing shops, building heavy machinery, successful in bettering production, good designer, desires position as manager or chief engineer.

267 Mechanical engineer with broad experience in sugar machinery desires position as chief engineer or representative with manufacturing concern.

268 Member, with twenty years' experience as superintendent and manager of large manufacturing concerns, open for engagement. Applicant is up-to-date in all the latest shop methods and able to produce large quantities of work at minimum cost. Can handle the office and carry out the business end.

269 Engineer, age 30, technical graduate, desires position as manager, superintendent or engineer; experience in shop, drafting, devising, and installing cost, shop and production systems, and in electrical installations for industrial plants.

270 Affiliate (Gas Power Section), supervising draftsman or assistant superintendent, age 31, practical man with technical education; five years shop, three and one-half years drafting-room experience; gas engines, gas producers and automobiles; Middle West preferred.

271 Sales engineer now connected with prominent firm of engineers and contractors; fifteen years' experience with pumping machinery, air compressors, and steam-plant contracting. Considerable experience in directing sales campaigns and handling salesmen; capable executive and organizer: prefers location on Pacific Coast, Denver or Mexico.

272 Member desires position as superintendent or manager; now employed; principal experience in manufacturing machine shop and gray-iron foundry, as organizer and executive; medium and small work in quantity and quality, such as steam and power pumps.

273 Member, competent salesman and engineer, located in New York City. Experienced estimator and designer on special work and manufacturing plant equipments. Open for engagement to act as Eastern representative.

274 Junior, twenty-eight years of age. At present, designing engineer with large company building anthracite producers, gas engines, Corliss engines and special machinery. Have had excellent experience in shops and in erecting engines and machinery. Desire to take position as assistant to chief engineer or as chief draftsman. Prefer to locate in New York or vicinity. Can furnish the very best of references as to ability and character.

275 Mechanical and electrical engineer, fifteen years' experience in railway, lighting and industrial plants. Manager, designer, or superintendent of construction.

276 Junior technical graduate, at present located in drafting room of motor power department of railroad, desires to change; has served a three years' special apprenticeship in shop and round house and four years drafting, part of the time engaged in locomotive testing and also testing different railway appliances.

CHANGES IN MEMBERSHIP

CHANGES OF ADDRESS

ALTA, Lucas Nicholas (1896), Mech. Engr. and member of Firm, L. N. Alta & Co., 35 Binnenkant, Amsterdam, and *for mail*, Breedeweg 26, Watergraafsmeer, Holland.

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ANGSTROM, Carl (1883), Cons. Engr., Stockholm Ö, Sweden.

BALDWIN, Abram T. (1899; 1902), Life Member; Solvay Process Co., Detroit, Mich.

BARKER, Fred P. (Associate, 1907), Inspr., U. S. Engr. Office, and *for mail*, 511 West Ave., Buffalo, N. Y.

BARNES, William O. (1908), Asst. Supt., Miller Lock Co., Philadelphia, and *for mail*, 4642 Penn St., Frankford, Philadelphia, Pa.

BIERBAUM, Christopher H. (1894; 1898), Life Member; Cons. Engr., V.P., Lumen Bearing Co., Robson Smelting Co., Pres., Molyneux Mailing Machines Co., 616 Prudential Bldg., and 80 Fargo Ave., Buffalo, N. Y.

BRADSHAW, Grant D. (Junior, 1904), Foreman Billet Mill, Ill. Steel Co., and *for mail*, Box 532, Gary, Ill.

BUCKLEY, John Francis (1906), Cons. Engr. to Genl. Supt., St. Marys Mch. Co., St. Marys, O.

BURLINGAME, Luther D. (1903), Ch. Draftsman, Brown & Sharpe Mfg. Co., and *for mail*, 15 Catalpa Rd., Providence, R. I.

COLE, Cyrus L. (Junior, 1908), Allis-Chalmers Co., and *for mail*, 1862 Magnolia Ave., Chicago, Ill.

COMSTOCK, Charles Warren (Associate, 1906), Cons. Engr., Caxton Bldg., and 1960 E. 97th St., Cleveland, O.

CROLL, A. Gilbert (Associate, 1901), Supt., Atlas Portland Cement Co., Northampton, and *for mail*, 30 S. West St., Allentown, Pa.

CRUIKSHANK, Barton (1889; 1890), Cons. Engr., Morristown, N. Y.

CURTIS, Greely S. (1897; 1904), Cons. Engr., Fire Dept. Expt., 73 Maiden Lane, New York, and Rye, N. Y.

DAWLEY, Clarence A. (Junior, 1904), Cons. Engr., 323 W. 77th St., New York, N. Y.

DOW, Carl Stephen (1899; Associate, 1905), with Walter B. Snow, 170 Summer St., Boston, and *for mail*, 24 Milton Sq., Hyde Park, Mass.

DRAPER, Wm. L. (1899), Main St., Yarmouthport, Mass.

DULL, Raymond Wm. (1908), Ch. Engr., Stephens Adamson Mfg. Co., and *for mail*, 464 Garfield Ave., Aurora, Ill.

DUNHAM, George W. (1908), Ch. Engr., Hudson Motor Car Co., and 155 W. Euclid Ave., Detroit, Mich.

DU VILLARD, Henry A. (1884), Mech. Engr., 173 George St., East Side Sta., Providence, R. I.

EAYRS, Thomas C. (Junior, 1905), Westinghouse Elec. and Mfg. Co., 1104 Traction Bldg., Cincinnati, O.

ESTES, William Wood (1891; 1904), Designer, Taft-Pierce Co., Woonsocket, and *for mail,* 245 Waterman St., East Side Sta., Providence, R. I.

FAIRBANKS, Adolphe S. (1899; Associate, 1904), Philadelphia Rep., Engrg. Dept., Vandyck-Churchill Co., 917 Arch St., Philadelphia, Pa.

FENNER, David C. (1906), 1966–1968 Broadway, New York, N. Y., and 705 Ravine Rd., Plainfield, N. J.

FERGUSSON, Henry A. (1902), Cons. Engr. and Dist. Sales Agt., Steel Roof Truss Co., 514 Bank of Commerce Bldg., St. Louis, Mo.

FIEUX, Ernest D. (Junior, 1907), V. P., Genl. Mgr. and Treas., L. J. Wing Mfg. Co., 90 West St., and *for mail,* 200 Claremont Ave., New York, N. Y.

FOSTER, Horatio A. (1895), Detroit United Ry., 12 Woodward Ave., Detroit, Mich.

GAMON, Ernest E. (Junior, 1904), Mfr., Water Meters, and *for mail,* 420 Summer Ave., Newark, N. J.

GANTT, Henry L. (1888), Manager, 1908–1911; Cons. Engr., Engineers Club, 32 W. 40th St., New York, N. Y.

GARDNER, L. H. (Junior, 1906), Ch. Engr., Herzog Iron Wks., 1044 E. 7th St., and 536 Ashland Ave., St. Paul, Minn.

GAY, Harry (Associate, 1907), Asst. Engr., N. Y. C. & H. R. R. R., 1219 Grand Central Sta., and *for mail,* 612 W. 137th St., New York, N. Y.

GERRISH, William H. (1901), Supt., Travers Mfg. Co., 542 W. 52d St., New York, N. Y., and 71 17th Ave., Paterson, N. J.

HARMAN, John J. (Junior, 1906), Mech. Engr., Harman Engrg. Co., 120 Fredonia Ave., Peoria, Ill.

HART, Frederick L. (1891), 53 Clinton Ave., Jamaica, L. I., N. Y.

HAWKS, Arthur S. (1904; 1909), Engr. Power Dept., Bethlehem Steel Co., South Bethlehem, and 313 Wall St., Bethlehem, Pa.

HAWLEY, Wm. Parker (Junior, 1903), Instr. Mech. Drawing, Lewis Inst., Chicago, and 320 N. 64th Ave., Oak Park, Ill.

HERDMAN, Frank E. (1889), Mgr. and Engr., Water and Light Properties, Winnetka, Ill.

HERRON, James H. (1897; 1905), 2082 E. 90th St., Cleveland, O.

HERTER, Emil (1894), Mech. Engr., Edison Portland Cement Co., Edison Lab., and *for mail,* 129 Park Ave., Orange, N. J.

HOUGH, David L. (1891; 1892), Pres., United Engrg. and Contr. Co., Managing Dir., Cuban Engrg. and Contr. Co., 17 W. 42d St., New York, N. Y.

HOWARD, Chas. Alton (Junior, 1907), E. W. Bliss Co., Adams and Plymouth Sts., Brooklyn, and *for mail,* 519 W. 124th St., New York, N. Y.

HUTCHINSON, Arthur H. (1899), C. W. Kettering Mercantile Co., and *for mail,* 1617 Wazee St., Denver, Colo.

JAKOBSSON, Herman G. (1907), Ordnance Designer, War Dept., Washington, D. C.

JEWETT, Frank N. (1908), Sales Mgr., Wagner Elec. Mfg. Co., 6400 Plymouth Ave., and *for mail,* 6 Parkland Pl., St. Louis, Mo.

JOHNSON, F. Amos (1907), 22 Morris St., Jersey City, N. J.

JOHNSON, J. E., Jr. (1896; 1901), 1002 King St., Wilmington, Del.
KEITH, Robert R. (Junior, 1904), Asst. Supt., A. O. Smith Co., and *for mail*, Flat 1, 296 Oakland Ave., Milwaukee, Wis.
KEITH, Thomas M. (Junior, 1905), Genl. Mgr., Link Chain Belt Co., 52 Dey St., New York, and *for mail*, 241 Clifton Pl., Brooklyn, N. Y.
KIRKUP, Joseph P. (Junior, 1908), 1421 Arch St., Philadelphia, Pa.
LANE, Francis W. (Associate, 1900), 537 W. 67th St., Chicago, Ill.
LEWIS, Joseph E. (Junior, 1899), Treas., Bush Mfg. Co., and *for mail*, 33 Barnard St., Hartford, Conn.
LOUD, Henry S. (1901), Ch. Engr., U. S. Wood Preserving Co., 165 Broadway, New York, N. Y., and *for mail*, Morristown, N. J.
McDEVITT, Frank J. (Junior, 1906). V. P. and Mgr., Ohio Steam Specialty Co., and *for mail*, 1011 Mahoning Ave., Youngstown, O.
McGREGOR, Alexander Grant (Junior, 1905), 118 T St., Salt Lake City, Utah.
McKECHNIE, Robert R. (1897), South Euclid, O.
MAGIN, Frank W. (Junior, 1907), Allis-Chalmers Co., 71 Broadway, New York, N. Y.
MEAKER, Guy Larnard (Junior, 1904), Asst. Supt., Am. Steel Wire Co., Rockdale Wks., and *for mail*, 216 Grover St., Joliet, Ill.
METZ, Walter R. (Junior, 1902), Supt. of Bldgs., Govt. Ptg. Office, and *for mail*, 211 A St., N. E., Washington, D. C.
MILNE, James (1907), 23 7th Ave., W., Vancouver, B. C., Canada.
MORGAN, John R. (1901), Genl. Mgr., Calumet Engrg. Wks., Harvey, and 1838 W. 99th St., Walden, Chicago, Ill.
MORLEY, Ralph (Junior, 1906), Mech. Engr., Transmission Dept., The Fairbanks Co., New York, and *for mail*, 563 9th St., Brooklyn, N. Y.
MORRISON, Herbert H. (1898; 1904), Cons. Engr., Syndicate Trust Bldg., St. Louis, Mo.
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NAYLOR, Chas. Wm. (1905), Ch. Engr., Marshall Field & Co., 83 State St., and *for mail*, 2275 Congress St., Chicago, Ill.
NEWBURY, George K. (Junior, 1904), Mgr. Plate Dept., Newbury Mchy. Co., 304 Century Bldg., Denver, Colo.
NOBLE, Alfred (1907), Civil Engr., 7 E. 42d St., New York, N. Y.
OWEN, Ira June (Junior, 1905), Cons. Engr., 855–7 First Natl. Bank Bldg., Chicago, and 110 Maple Ave., Oak Park, Ill.
PATTERSON, A. W., Jr. (1897; 1903), 409 P. O. Sq. Bldg., Boston, Mass.
PEARSON, Walter Ambrose (1907), Rio de Janeiro Tramway, Light and Power Co., Ltd., Avenida Central, 76, Rio de Janeiro, Brazil, South America.
POSSELT, Ejnar (Junior, 1907), Mech. Engr. and Asst. Mgr., St. Louis Portland Cement Wks., and *for mail*, Hotel Berlin, St. Louis, Mo.
POWEL, Samuel W. (1880), Asst. Mech. Engr., Am. Radiator Co., care Pierce Plant, and *for mail*, 679 Auburn Ave., Buffalo, N. Y.
RANDALL, Dwight T. (1904), A. D. Little Co., 93 Broad St., Boston, Mass.
RIPPEY, S. Howard (1904; 1905), Cons. Engr., Sellers & Rippey, 1301 Stephen Girard Bldg., Philadelphia, Pa.
RUGGLES, Wm. Barker (1905), Pres., Ruggles-Coles Engrg. Co., 50 Church St., New York, N. Y., and 91 W. 5th St., Bayonne, N. J.
ST. CLAIR, James Thorpe (Junior, 1901), 5821 Clemens Ave., St. Louis, Mo.

SAGUE, Samuel R. (Junior, 1908), Sales Engr., Power House Equip., Strong, Carlisle & Hammond Co., and *for mail*, 79 Belmore Rd., Cleveland, O.

SHALLENBERGER, Louis R. (1895; 1902), 239 Maple Ave., Oak Park, Ill.

SHEPHERD, Wm. G. (1890; 1904), V. P. and Genl. Mgr., Shepherd Engrg. Co., Williamsport, Pa.

SMEAD, William H. (Junior, 1906), P. O. Box 699, Atlanta, Ga.

SNOW, Sylvester M. (1890), Snow & Humphreys, Room 62, 85 Water St., Boston, Mass., and *for mail*, 257 Gano St., East Side Sta., Providence, R. I.

SPIRO, Charles (1908), Genl. Mgr., Columbia Typewriter Mfg. Co., and *for mail*, 10 W. 121st St., New York, N. Y.

STEARNS, Albert (1880), Supt., Church & Dwight Co., 1406–1446 Willis Ave., and 329 James St., and *for mail*, P. O. Box 74, Syracuse, N. Y.

SYMONS, Wilson E. (1899), Supt. M. P. and Mchy., Chicago Great Western Ry., Met. Opera House Blk., St. Paul, Minn.

TAKEO, Toshisuke (1908), Genl. Mgr., Karatsu Iron Wks., Nishikaratsu, Hizen, Japan.

THULLEN, L. H. (1905), Mech. and Elec. Engr., 96 William St., East Orange, N. J.

VANDERBILT, Aaron (1880; 1884; 1908), Life member; Westhampton, L. I., N. Y.

VAN WINKLE, Edward (1904; 1908), Cons. Pat. Engr., West St. Bldg., Cedar and West Sts., New York, and The Stuyvesant, 483 Park Pl., Brooklyn, N. Y.

von PHILP, C. (1890), Mgr. Mchy. Dept., Bethlehem Steel Co., South Bethlehem, Pa.

WEST, Thos. D. (1884), West Steel and Iron Casting Co., E. 70th St., Cleveland, O.

WESTON, Frederick W. (Associate, 1907), Rep. Baldwin Loco. Wks., Standard Steel Wks. Co., 50 Church St., and 14 W. 48th St., New York, N. Y.

WILCOX, Perley Smith (Junior, 1899), Asst. Mgr. Kodak Part Wks., Eastman Kodak Co., and *for mail*, 10 Audubon St., Rochester, N. Y.

WILLIAMS, Ernest D. (Junior, 1905), Turbine Dept., Genl. Elec. Co., and *for mail*, 1306 Union St., Schenectady, N. Y.

WRIGHT, Reginald A. (1907), Ch. Draftsman, Phila. & Reading Coal and Iron Co., and *for mail*, Y. M. C. A. Bldg., Pottsville, Pa.

NEW MEMBERS

ALDRICH, Chester S. (Junior, 1909), Managing Partner, Gray-Aldrich Co., 7 Commercial Wharf, Boston, Mass.

ALGER, Harley C. (Junior, 1908), Supt., Willcox Engrg. Co., and *for mail*, 300 Simonean St., Saginaw, Mich.

AYERS, Norwood B. (1908), Ch. Engr., Dayton Lighting Co., 124 E. 4th St., and 422 Summers St., Dayton, O.

BABBITT, Edward F. (1909), Engr. with F. L. Packard, Arch., and *for mail*, 406 S. Ohio Ave., Columbus, O.

BEHREND, Bernard A. (1909), Elec. and Mech. Engr., 5754 Howe St., E.E., Pittsburg, Pa.

BLUMGARDT, Isaac E. (Associate, 1908), 501 W. 143d St., New York, N. Y.

BOND, Francis M. (Junior, 1909), Forest Service, Washington, D. C.

BROWN, John Rowland (1900; 1904; 1909), Mech. Engr., Ohio Brass Co., Mansfield, O.

BRUCKNER, Rudolph E. (1909), Ch. Engr., Commercial Acetylene Co., 80 Broadway, New York, N. Y.

BUMP, Archie Edmund (Associate, 1908), Mgr. Constr. Dept., Swift & Co., 34 N. Market St., Boston, Mass.

BUSHNELL, Douglas S. (1909), Genl. Supt., Natl. Transit Co., 26 Broadway, New York, N. Y.

CARPENTER, Allan O. (Associate, 1909), Ch. Draftsman, Chicago Pneumatic Tool Co., and *for mail*, Box 271, Franklin, Pa.

CROCKARD, Frank H. (1909), V. P. and Genl. Mgr., Tenn. Coal, Iron and R. R. Co., Birmingham, Ala.

DISERENS, Paul (Junior, 1908), Research Asst., Univ. of Ill., and *for mail*, 203 W. Green St., Urbana, Ill.

DUNCAN, Albert Greene (1909), Treas., Chicopee Mfg. Co., and *for mail*, 70 Kilby St., Boston, Mass.

ENNIS, J. B. (1909), Asst. to Mech. Engr., Am. Loco. Co., 50 Church St., New York, N. Y., and *for mail*, 615 E. 24th St., Paterson, N. J.

FESSENDEN, Chas. Horace (Junior, 1909), Instr. Mech. Engrg., Univ. of Mich., Room 225, New Engrg. Bldg., Ann Arbor, Mich.

HAMILTON, Chester B., Jr. (Junior, 1909), Draftsman, 43 Madison Ave., Toronto, Ont., Canada.

HART, Robert W. (Associate, 1909), New England Mgr., Olds Gas Power Co., Boston, and 11 Glengarry, Winchester, Mass.

HEM, H. O. (1909), V. P. and Supt., H. N. Strait Mfg. Co., and 721 W. 18th St., Kansas City, Mo.

HOGUE, Oliver D. (1909), Mgr., Power Pump Dept., Goulds Mfg. Co., 1106 Tremont Bldg., Boston, Mass.

HUNTER, John A. (1909), Steam Engr., Am. Sheet and Tin Plate Co., Pittsburg, and *for mail*, 553 Mifflin Ave., Wilkinsburg, Pa.

JEWETT, Arthur C. (1909), Prof. Mech. Engrg., Univ. of Maine, Orono, Me.

JONES, Walter I. (1909), Cons. Engr., 60 Wall St., New York, N. Y.

KELLOGG, Harry F. (1909), Mech. Engr., Chicago, New York & Boston Refrigerator Co., and *for mail*, 5431 Jefferson Ave., Chicago, Ill.

KESSLER, Armin Geo. (Junior, 1909), Instr., Sibley College, Cornell Univ., and *for mail*, 805 E. State St., Ithaca, N. Y.

KING, Geo. Caryl (1908), Asst. Genl. Mgr. and Mech. Engr., Union Irrigation Co., and *for mail*, P. O. Box 133, Washington, La.

KNIGHT, Alfred H. (1909), Asst. Prof. Mech. Engrg., Univ. of Mich., and 1105 Oakland Ave., Ann Arbor, Mich.

LEE, Ralph A. (Junior, 1909), Mech. Draftsman, 414 78th St., Brooklyn, N. Y.

MAXWELL, Max Carson (1908), Head Instr. Applied Mech., Pratt Inst., Brooklyn, N. Y.

PECK, Eugene C. (1909), Genl. Supt., Cleveland Twist Drill Co., and 1242 E. 49th St., Cleveland, O.

PELLISSIER, George E. (Associate, 1909), Ch. Engr., Goldschmidt Thermit Co., 90 West St., and 510 W. 143d St., New York, N. Y.

PHELPS, Charles C. (Junior, 1909), Gage Pub. Co., 114 Liberty St., New York, N. Y.

PLUNKETT, Charles T. (1909), V. P. and Secy., Berkshire Cotton Mfg. Co., Adams, Mass.

PUCHTA, Edward (1909), Asst. Supt., Western Elec. Co., 48th Ave. and W. 24th St., and *for mail,* 59 Buena Ave., Chicago, Ill.

PULIS, Wm. Eugene (Junior, 1909), Industrial Engr., Sayles Bleacheries, and *for mail,* P. O. Box 11, Saylesville, R. I.

RICHARDSON, Levi S. (1909), Draftsman, N. Y. Edison Co., New York, and *for mail,* Rosebank, S. I., N. Y.

RILEY, Joseph C. (1909), Asst. Prof. Mech. Engrg., Mass. Inst. of Tech., Boston, Mass.

SEARLE, Wilbur C. (Junior, 1909), Heald Mch. Co., and *for mail,* 10 Townsend St., Worcester, Mass.

SHENBERGER, Geo. H. (Junior, 1909), Draftsman, Lehigh Coal and Navigation Co., and *for mail,* Lansford, Pa.

SMITH, Carl D. (Junior, 1909), Asst. Engr., Tech. Branch, U. S. Geolog. Survey, 40th and Butler Sts., Pittsburg, Pa.

STANTON, Alden D. (Junior, 1909), Ch. Draftsman, Dept. Bldgs. and Grounds, Columbia Univ., New York, and *for mail,* 378 Greene Ave., Brooklyn, N. Y.

TAYLOR, John W. (Junior, 1909), Ch. Draftsman, Russell Eng. Co., and *for mail,* 88 3d St., Massillon, O.

THOMPSON, Edward C. (Junior, 1909), Mech. Engr. and Mgr., C. W. Traner Mfg. Co., and *for mail,* 89 Pearl St., Boston, Mass.

THOMPSON, Sanford E. (1909), Cons. Engr., Newton Highlands, Mass.

THURSTON, Edward D., Jr., (Junior, 1909), Asst. Dept. Mech. Engrg., Columbia Univ., and *for mail,* 617 W. 113th St., New York, N. Y.

TIPLADY, John T. (1909), Supt. Mch. and Power Plant, Variety Iron and Steel Wks. Co., Cleveland, O.

TUTTLE, Irving E. (Junior, 1909), Mech. Draftsman, Westinghouse, Church, Kerr & Co., New York, and *for mail,* 198 Greene Ave., Brooklyn, N. Y.

WHITING, Richard A. (Junior, 1909), Instr. Exper. Engrg., Stevens Inst., Hoboken, N. J., and *for mail,* 137 W. 117th St., New York, N. Y.

WILLS, C. Harold (1909), Ch. Engr. and Factory Mgr., Ford Motor Co., and *for mail,* 39 Bethune Ave., W., Detroit, Mich.

WILLSON, Ernest M. (Associate, 1909), Ch. Draftsman, Hart-Parr Co., and *for mail,* 601 Wisconsin St., Charles City, Ia.

WOOLLEY, Harold O. (Junior, 1909), Draftsman, Power Specialty Co., Dansville, N. Y.

PROMOTIONS

CASTANEDO, Walter (1907; 1909), Member of Firm, Glenny & Castanedo, 1125–27 Maison Blanche Bldg., and *for mail,* 1514 Peters Ave., New Orleans, La.

CHATARD, Wm. Miles (1903; 1909), Dist. Mgr., Carbondale Mch. Co., 1412 Continental Bldg., and 5 W. Chase St., Baltimore, Md.

DALE, Orton G. (1894; 1909), Mgr., Mead-Morrison Mfg. Co., 11 Broadway, New York, N. Y., and Plainfield, N. J.

DILLARD, James B. (1907; Associate, 1909), Capt. Ordnance Dept., War Dept., Washington, D. C.

HUNTER, James Francis (1899; 1909), Asst. Engr. of Constr., Cons. Gas Co., 4 Irving Pl., New York, N. Y., and 1517 Bolton St., Baltimore, Md.

IDELL, Percy C. (1901; Associate, 1909), Sales Dept., Babcock & Wilcox Co., 85 Liberty St., New York, N. Y., and *for mail*, 1026 Hudson St., Hoboken, N. J.

KILGOUR, Dwight F. (1905; 1909), Mech. Engr., Chas. E. Cotting, Trustee, 11 Pemberton Sq., Boston, Mass.

POMEROY, L. R. (1890; 1909), Asst. to Pres., Safety Car Heating and Lighting Co., 2 Rector St., New York, N. Y., and 24 Reynolds Terrace, Orange, N. J.

ROBINSON, Garland P. (1902; 1909), Pub. Service Com., 2d Dist., Albany, N. Y.

WHITTED, Thomas B. (1900; 1903; 1909), Pres., Thomas B. Whitted & Co., Contr. Engrs., Piedmont Bldg., and 317 W. 5th St., Charlotte, N. C.

DEATHS

CALDWELL, Andrew J.

GAS POWER SECTION

CHANGES OF ADDRESS

DAWLEY, Clarence A. (1908), Cons. Engr., 323 W. 77th St., New York, N. Y.

HOWARD, Chas. Alton (1908), E. W. Bliss Co., Adams and Plymouth Sts., Brooklyn, and *for mail,* 519 W. 124th St., New York, N. Y.

MORLEY, Ralph (1908), Mech. Engr., Transmission Dept., The Fairbanks Co., New York, and *for mail,* 563 9th St., Brooklyn, N. Y.

MORRISON, Herbert H. (1908), Cons. Engr., Syndicate Trust Bldg., St. Louis Mo.

THULLEN, L. H. (1908), Mech. and Elec. Engr., 96 William St., East Orange, N. J.

VAN WINKLE, Edward (1908), Cons. Pat. Engr., West St. Bldg., Cedar and West Sts., New York, and The Stuyvesant, 483 Park Pl., Brooklyn, N. Y.

VERKOUTEREN, A. J. (Affiliate, 1908), Cons. Engr., 35 Richelieu Terrace, Newark, N. J.

NEW MEMBERS

BAILY, Thaddeus F. (Affiliate, 1909), Genl. Mgr. and Engr., Baily Eng. Co., Alliance, O.

BALLIN, Alfred Edward (1909), Asst. Ch. Engr., Snow Steam Pump Wks., and 188 W. Utica St., Buffalo, N. Y.

BULMER, Wm. Carr (Affiliate, 1909), 525 Division Ave., Ann Arbor, Mich.

COLE, Arthur W. (1909), Instr. Mech. Engrg., Purdue Univ., Lafayette, and *for mail.* 224 Waldron St., West Lafayette. Ind.

DOW, Benjamin W. (Affiliate, 1909), 7 Standish St., Dorchester, Mass.

ENGLISH, Harry K. (1909), Box 688, Gary, Ind.

FAIRFIELD, Howard P. (1909), Instr., Worcester Poly. Inst., and *for mail,* 25 John St., Worcester, Mass.

FULLER, Edgar H. (Affiliate, 1909), Sales Mgr., Root & Van Dervoort Engrg. Co., East Moline, Ill.

GOLDINGHAM, Arthur H. (1909), De La Vergne Mch. Co., Foot E. 138th St., and *for mail,* 457 W. 123d St., New York, N. Y.

GORE, Warren W. (1909), V.P., Gas Power Mfg. Co., Seattle, and *for mail,* 1610 Main St., Olympia, Washington.

GRAVES, Carleton A. (Affiliate, 1909), Power Engr., Edison Elec. Co., 360 Pearl St., Brooklyn, N. Y.

LANG, Charles (1909), N. Y. Mgr., C. H. Wheeler Mfg. Co., 114 Liberty St., New York, and 348 Jefferson Ave., Brooklyn, N. Y.

LUTHER, Stephen G. (1909), Asst. Ch. Draftsman, Gas Eng. Dept., Snow Steam Pump Wks., and *for mail,* 469 Prospect Ave., Buffalo, N. Y.

MACNEILL, M. B. (Affiliate, 1909), Hyd. Engr., Watson-Stillman Co., New York, N. Y., and *for mail*, 251 North Ave., W., Cranford, N. J.

MORDEN, Charles W. (Affiliate, 1909), 206 West St., Worcester, Mass.

MUNRO, George W. (Affiliate, 1909), Purdue Univ., Lafayette, Ind.

PARKER, Charles H. (1909), Asst. Supt. Generating Dept., Boston Edison Co., 3 Head Pl., and 260 Clarendon St., Boston, Mass.

PERCY, Earle N. (1909), Engr., Imperial Gas Eng. Co., and *for mail*, 3570 Clay St., San Francisco, Cal.

PIERSON, Robert M. (Affiliate, 1909), Pat. Solicitor, 149 Broadway, New York, N. Y.

ROBINSON, Edward P. (1909), Supt., Atlantic Wks., 80 Border St., East Boston, Mass.

SOUTHWORTH, Martin O. (1909), Elec. Engr., Fairbanks, Morse & Co., 481 Wabash Ave., and *for mail*, Hotel Windemere, Chicago, Ill.

THOMPSON, Wm. K. (Affiliate, 1909), Secy., Western Gas Eng. Co., 908 N. Main St., Los Angeles, Cal.

WARMAN, William A. (1909), Supt. and Designer, Keller Mech. Engr. Co., 570 W. Broadway, New York, N. Y.

COMING MEETINGS

Secretaries or members of societies whose meetings are of interest to engineers are invited to send in their nctices for publication in this department. Such notices should be in the editor's hands by the 15th of the month preceding the meeting.

AËRONAUTIC SOCIETY
June 16, etc., evenings, weekly meetings, Automobile Club of America, W. 54th St., New York. Secy., Wilbur R. Kimball.

AMERICAN BOILER MANUFACTURERS ASSOCIATION
August 10–12, Hotel Ponchartrain, Detroit, Mich. Secy., J. D. Farasey, E. 37th St. and Erie Ry., Cleveland, O.

AMERICAN CHEMICAL SOCIETY
June 29–July 2, Detroit, Mich. Secy., Chas. L. Parsons, Durham, N. H.

AMERICAN GAS POWER ASSOCIATION
July 22, quarterly meeting, Minneapolis, Minn. Secy., R. P. Gillette.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS
June 24–25, semi-annual meeting, Polytechnic Institute, Brooklyn, N. Y. Papers: The Utilization of Low Grade Fuels in the United States, O. K. Zwingneberger; Creosote Oil from Coal Gas Tar, S. P. Sadtler; Automatic Acid Egg, Richard K. Meade; Some Experiments on Case Hardening of Steel with Gases, J. C. Olsen; New York Metropolitan District as a Center for Great Industries, C. F. McKenna; Methods of Clay Control, J. G. Dean. Secy., J. C. Olsen.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
June 28, Annual Convention, Frontenac, N. Y. Secy., Ralph W. Pope, 33 W. 39th St., N. Y.

AMERICAN PORTLAND CEMENT MANUFACTURERS
July 13, quarterly meeting, Philadelphia, Pa. Secy., Percy H. Wilson, Land Title Bldg.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION
June 16–18, Annual Convention, Atlantic City, N. J. Secy., Jos. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS
June 16, September 1, semi-monthly meetings, 220 W. 57th St., New York, July 6–9, Annual Convention, Mt. Washington Hotel, Bretton Woods, N. H. Secy., C. W. Hunt.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
July 15, 16, summer meeting, Indianapolis, Ind. Secy., W. M. Mackay, P. O. Box 1818, New York.

AMERICAN SOCIETY OF HUNGARIAN ENGINEERS AND ARCHITECTS
June 5, 29 W. 39th St., New York, 8.30 p.m. Secy., Zoltan de Németh, 103 E. 16th St.

AMERICAN SOCIETY OF SWEDISH ENGINEERS
September 4, semi-monthly meeting, Brooklyn, N. Y. Secy., E. Hammerstrom, 271 Hicks St.

AMERICAN SOCIETY FOR TESTING MATERIALS
June 29–July 3, annual meeting, Hotel Traymore, Atlantic City, N. J. Secy., Edgar Marburg, Univ. of Penna., Philadelphia, Pa.

AMERICAN WATER WORKS ASSOCIATION
June 8–12, Annual Convention, Milwaukee, Wis. Secy., J. M. Diven, 14 George St., Charleston, S. C.

ASSOCIATION OF CAR LIGHTING ENGINEERS
June 7, semi-annual meeting, New York. Secy., G. B. Colegrove, 6250 Drexel Ave., Chicago, Ill.

ASSOCIATION OF RAILWAY CLUB SECRETARIES
June 19, annual meeting, Atlantic City, N. J.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS
June 23–25, Detroit, Mich. Secy., P. W. Drew, Room 511, Harvester Bldg., Chicago, Ill.

BLUE ROOM ENGINEERING SOCIETY
July 1, August 5, monthly meetings, 29 W. 39th St., New York, 8 p.m. Secy., W. D. Sprague.

BOSTON SOCIETY OF CIVIL ENGINEERS
June 16, monthly meeting, Tremont Temple. Secy., S. E. Tinkham, 60 City Hall.

BROOKLYN ENGINEERS' CLUB
June 3, 117 Remsen St. Paper: Gas Engines, Geo. A. Orrok. June 10, Machinery Club, 50 Church St. Secy., Joseph Strachan.

CANADIAN ELECTRICAL ASSOCIATION
June 16–18, annual Convention, Quebec. Secy., T. S. Young, Confederation Life Bldg., Toronto.

CANADIAN FREIGHT ASSOCIATION
July 15, quarterly meeting, Secy., T. Marshall, Toronto.

CANADIAN GAS ASSOCIATION
June 25, annual meeting, Toronto, Ont. Secy., A. W. Moore, Woodstock.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION
September, annual meeting. Secy., F. P. Wilson, 405 Confederation Life Bldg., Toronto.

CANADIAN RAILWAY CLUB
September 7, monthly meeting, 8 p.m., Windsor Hotel, Montreal, Que. Secy., Jas. Powell, St. Lambert, P. Q.

CAR FOREMEN'S ASSOCIATION OF CHICAGO
June 14, monthly meeting, Masonic Temple. Secy., Aaron Kline, 326 N. 50th St.

CENTRAL RAILWAY CLUB.
September 10, Hotel Iroquois, Buffalo, N. Y., 8 p. m. Secy., H. D. Vought, 95 Liberty Street, New York.

COLORADO SCIENTIFIC SOCIETY
July 3, monthly meeting, Denver. Secy., Dr. W. A. Johnston, 801 Symes Bldg.

DENVER SOCIETY OF CIVIL ENGINEERS
June 8, monthly meeting, 36 Jacobson Bldg. Secy., Walter Pearl.

ELECTRIC CLUB OF CHICAGO
June 16, etc., weekly meetings, noon, Chicago Automobile Club. Secy., W. S. Taussig, Marquette Bldg.

ENGINEERING ASSOCIATION OF THE SOUTH
June 15, monthly meeting. Secy., H. M. Jones, 2 Berry Blk., Nashville, Tenn.

ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE, KY.
June 21, monthly meeting, 303 Norton Bldg. Secy., Pierce Butler.

ENGINEERS' CLUB OF CENTRAL PENNSYLVANIA
September 7, monthly meeting, Gilbert Bldg., Harrisburg. Secy., E. R. Dasher.

ENGINEERS' CLUB OF CINCINNATI
June 17, monthly meeting, 25 E. 8th St. Secy., E. A. Gast, P. O. Box 333.

ENGINEERS' CLUB OF MINNEAPOLIS
June 21, July 19, August 16, monthly meetings, City Hall.

ENGINEERS' CLUB OF PHILADELPHIA
September 4, etc., semi-monthly meetings, 1122 Girard St. Secy., W. P. Taylor.

ENGINEERS' CLUB OF ST. LOUIS
June 16, September 1, semi-monthly meetings, 3817 Olive St. Secy., R. H. Fernald.

ENGINEERS' CLUB OF TORONTO
June 17, 24, September 2, etc., weekly meetings, 96 King St., W. Secy., R. B. Woolsey.

ENGINEERS' SOCIETY OF MILWAUKEE
June 9, annual meeting, September 8, monthly meeting, 456 Broadway. Secy., W. Fay Martin.

ENGINEERS' SOCIETY OF PENNSYLVANIA
June 15, regular meeting, September 7, section meeting. Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburgh, Pa.

FREIGHT CLAIM ASSOCIATION
June 16, annual meeting, Old Point Comfort, Va. Secy., W. P. Taylor, Richmond, Va.

INTERNAL COMBUSTION ENGINEERS ASSOCIATION
June 11, July 9, August 13, monthly meetings, Sherman House, Chicago, Ill. Secy., H. R. Linn, 61 Ward St.

INTERNATIONAL ACETYLENE ASSOCIATION
August 9–11, annual meeting, Hotel Knickerbocker, New York. Secy., A. Cressy Morrison, 157 Michigan Ave., Chicago, Ill.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS
August 17–20, Grand Rapids, Mich. Secy., Jas. McFall, Roanoke, Va.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION
August 18, Niagara Falls, N. Y. Secy., A. L. Woodworth, Lima, O.

INTERNATIONAL RAILWAY FUEL ASSOCIATION
June 21–23, annual meeting, Auditorium Hotel, Chicago, Ill. Secy., D. B. Sebastian, 327 La Salle St. Sta., Chicago.

IOWA DISTRICT GAS ASSOCIATION

June 23–25, annual meeting, Waterloo, Ia. Secy., G. I. Vincent, Des Moines.

IOWA RAILWAY CLUB

June 11, September 10, Union Sta., Des Moines. Secy., W. B. Harrison.

LOUISIANA ENGINEERING SOCIETY

June 14, monthly meeting, 321 Hibernia Bldg., New Orleans. Secy., L. C. Datz.

MASSACHUSETTS STREET RAILWAY ASSOCIATION

September 8, Young's Hotel, Boston. Secy., Chas. S. Clark, 70 Kilby St.

MASTER CAR BUILDERS' ASSOCIATION

June 21–23, annual Convention, Atlantic City, N. J. Secy., Jos. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

MASTER MECHANICS ASSOCIATION

June, Convention, Atlantic City, N. J.

MODERN SCIENCE CLUB

June 13, etc., weekly meetings, 125 S. Elliott Pl., Brooklyn, N. Y. Secy., Jas. A. Donnelly.

NATIONAL ASSOCIATION OF COTTON MANUFACTURERS

September, annual meeting. Secy., C. J. H. Woodbury, P. O. Box 3672.

NATIONAL ASSOCIATION OF GERMAN-AMERICAN TECHNOLOGISTS

August 28–31, annual meeting, 532 N. 4th St., Philadelphia, Pa. Secy., O. Güssefeldt, 456 Richmond St.

NATIONAL ELECTRIC LIGHT ASSOCIATION

June 1–4, Atlantic City, N. J. Papers: Private Policy, Paul Lüpke; Unique Features in Power Plant Design, G. L. Knight; Low-Pressure Steam Turbines, C. H. Smoot; Compilation of Load Factors, E. W. Lloyd; Electric Power, H. J. Gille; New York High-Pressure Fire System, Arthur Williams; Central Station Operation of Steam Plants in Connection with Central Station Service, S. Morgan Bushnell; etc. Secy., John F. Gilchrist, 29 W. 39th St., New York.

NATIONAL GAS AND GASOLENE ENGINE TRADES ASSOCIATION

June 22–24, Oliver Hotel, South Bend, Ind. Secy., A. Stritmatter, Cincinnati, Ohio.

NEWARK TECHNOLOGICAL SOCIETY

June 9, 842 Broad St., Newark, N. J. Secy., W. Riehl, 235 N. J. R. R. Ave.

NORTHERN RAILWAY CLUB

June 26, July 24, August 28, monthly meetings, Co mercial Club Rooms, Duluth, Minn. Papers: June, Demurrage, its Benefits, Necessity, etc., F. L. Klock; July, Steel vs. Wooden Freight and Passenger Cars, their Relative Cost, their Use and Repairs, etc., W. A. Clark; August, Steel vs. Wooden Ties, W. H. Hoyt. Secy., C. L. Kennedy, 401 W. Superior St.

OHIO ELECTRIC LIGHT ASSOCIATION

July 13–15, annual Convention, Toledo. Secy., D. L. Gaskill, Greenville.

PROVIDENCE ASSOCIATION OF MECHANICAL ENGINEERS

June 22, annual meeting, Alfredian Hall, 123 Eddy St. Secy., T. M. Phetteplace, 48 Snow St.

RENSSELAER SOCIETY OF ENGINEERS

June 18, 257 Broadway, Troy, N. Y. Secy., R. S. Furber.

RICHMOND RAILROAD CLUB

September 13, monthly meeting, 8 p.m. Secy., F. O. Robin on, C. & O. Ry.. Richmond, Va.

ROCHESTER ENGINEERING SOCIETY
June 11, July 9, August 13, monthly meetings. Secy., John F. Skinner, 54 City Hall.

ROCKY MOUNTAIN RAILWAY CLUB
June 19, monthly meeting. Secy., J. E. Buell, Denver, Colo.

ST. LOUIS RAILWAY CLUB
September 10, monthly meeting, Southern Hotel, 8 p.m. Secy., B. W. Frauenthal, Union Sta.

SCRANTON ENGINEERS' CLUB
June 17, July 15, August 19, monthly meetings, Board of Trade Rooms. Secy., A. B. Dunning.

SHORT LINE RAILROAD ASSOCIATION
July 13, August 10, 60 Wall St., New York. Secy., John N. Drake.

SOCIETY OF RAILWAY FINANCIAL OFFICERS
September 7, 8, Ft. William Henry, Lake George, N. Y. Secy., C. Norquist, Chicago, Ill.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB
August 19, quarterly meeting, Piedmont Hotel, Atlanta, Ga. Secy., A. J. Merrill.

TECHNICAL SOCIETY OF BALTIMORE
June 19, July 3, 17, August 7, 21, September 4, semi-monthly meetings, 1120 Harford Ave. Secy., Heinrich Türk, 1640 E. Baltimore St.

TECHNICAL SOCIETY OF BROOKLYN
September 3, Arion Hall, Arion Pl., 8.30 p.m. Secy., Oswald Gueth.

TECHNICAL SOCIETY OF CHICAGO
June 23, September 8, semi-monthly meetings, Hotel Bismarck, Randolph St. and 5th Ave. Secy., E. Reutner, 729 S. Millard Ave.

TECHNICAL SOCIETY OF NEW YORK
September 2, monthly meeting, 29 W. 39th St. Secy., Karl Kalbe.

TECHNICAL SOCIETY OF THE PACIFIC COAST
August 6, San Francisco, Cal. Secy., Otto von Geldern, 1978 Broadway.

TECHNICAL SOCIETY OF PHILADELPHIA
June 12, 26, September 11, semi-monthly meetings; July 3, annual meeting, 532 N. 4th St. Secy., O. Güssefeldt, 456 Richmond St.

TECHNICAL SOCIETY OF PITTSBURGH
June 23, September 8, semi-monthly meetings, 8 p.m., 222 Craft Ave. Secy., H. R. Setz.

TECHNICAL SOCIETY OF WASHINGTON
June 16, July 21, August 18, monthly meetings, 314 C St. N. W. Secy., Paul Bausch, 3418 Brown St. N. W.

TECHNOLOGY CLUB OF SYRACUSE
June 9, September 8, 502 Bastable Blk., 8 p.m. Secy., Robert L. A len.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA
June 15, annual Convention, Columbus, O. Secy., J. F. Mackie, La Salle St. Sta., Chicago, Ill.

TRAVELING ENGINEERS' ASSOCIATION
September, annual meeting, Denver, Colo. Secy., W. O. Thompson, Oswego, N. Y.

WESTERN CANADA RAILWAY CLUB

September 13, monthly meeting, Royal Alexandra Hotel, Winnipeg, Man. Secy., W. H. Rosevear.

WESTERN SOCIETY OF ENGINEERS

June 16, 1735 Monadnock Bldg., Chicago, Ill. Secy., J. H. Warder.

MEETINGS TO BE HELD IN ENGINEERING SOCIETIES' BUILDING

Date	Society	Secretary	Time
June 15	N. Y. Society Accountants & Bkprs	T. L. Woolhouse	8.00
June 15	New York Telephone Society	T. H. Laurence	8.00
June 22	N. Y. Society Accountants & Bkprs	T. L. Woolhouse	8.00
July 1	Blue Room Engineering Society	W. D. Sprague	8.00
Aug. 5	Blue Room Engineering Society	W. D. Sprague	8.00

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Chas. B. Dudley (4)
W. F. M. Goss (5)

Note.—Numbers in parentheses indicate length of term in years that the member has yet to serve.

SPECIAL COMMITTEES
1909

On a Standard Tonnage Basis for Refrigeration

D. S. Jacobus — G. T. Voorhees
A. P. Trautwein — Philip De C. Ball
E. F. Miller

On Society History

John E. Sweet — H. H. Suplee
Charles Wallace Hunt

On Constitution and By-Laws

Chas. Wallace Hunt, *Chairman* — F. R. Hutton
G. M. Basford — D. S. Jacobus
Jesse M. Smith

On Conservation of Natural Resources

Geo. F. Swain, *Chairman* — L. D. Burlingame
Charles Whiting Baker — M. L. Holman
Calvin W. Rice

On International Standard for Pipe Threads

E. M. Herr, *Chairman* — Geo. M. Bond
William J. Baldwin — Stanley G. Flagg, Jr.

On Thurston Memorial

Alex. C. Humphreys, *Chairman* — Charles Wallace Hunt
R. C. Carpenter — J. W. Lieb, Jr.
Fred J. Miller

On Hudson-Fulton Celebration

Geo. W. Melville — M. L. Holman
Jesse M. Smith

On Standards for Involute Gears

Hugo Bilgram — Gaetano Lanza
C. R. Gabriel — Wilfred Lewis
E. R. Fellows

On Power Tests

Edward T. Adams	D. S. Jacobus	Edward F. Miller
George H. Barrus	William Kent	Arthur West
L. P. Breckenridge	Charles E. Lucke	Albert C. Wood

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Walter M. McFarland .... Pittsburg, Pa.
Morgan Brooks .... Urbana, Ill.
David Townsend .... Philadelphia, Pa.
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SOCIETY REPRESENTATIVES

1909

On John Fritz Medal

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AMBROSE SWASEY (2) CHARLES WALLACE HUNT (4)

On Board of Trustees United Engineering Societies Building

CHAS. WALLACE HUNT (1) F. R. HUTTON (2)
FRED J. MILLER (3)

On Joint Library Committee

J. W. LIEB, JR., CHAIRMAN OF THE LIBRARY COMMITTEE OF THE AM. SOC. M. E.

On National Fire Protection Association

JOHN R. FREEMAN IRA H. WOOLSON

On Joint Committee on Engineering Education

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On Government Advisory Board on Fuels and Structural Materials

GEO. H. BARRUS P. W. GATES
W. F. M. GOSS

On Advisory Board National Conservation Commission

GEO. F. SWAIN JOHN R. FREEMAN
CHAS. T. MAIN

On Council of American Association for the Advancement of Science

ALEX. C. HUMPHREYS FRED J. MILLER

NOTE.—Numbers in parenthesis indicate length of term in years that the member has yet to serve.

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1909

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F. R. Low

SECRETARY

Geo. A. Orrok

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G. L. Knight
A. B. Steen
C. J. Davidson
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F. W. Walker
W. T. Donnelly
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Paul Winsor
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THE next monthly meeting will be held in the Engineering Societies Building on Tuesday evening, January 12. The paper will be by Carl G. Barth, Consulting Engineer, Philadelphia, Pa., upon The Transmission of Power by Leather Belting.

This will be one of the most comprehensive presentations of the subject of belting that has been given before the Society. The author has coöperated, during a period of 18 years, in the use of belting in manufacturing plants and especially machine shops where systems of management have been installed involving the scientific operation of machine tools. This has necessitated a careful study of the whole belting problem, both theoretically and practically, and has led to important conclusions which are given by the author in his paper. There has been ample opportunity to compare these conclusions with the results obtained in actual practice.

The theory which Mr. Barth has deduced is based on the well known experiments of Lewis and Bancroft and other members of the Society who have investigated different factors of the belting problem and his paper is, therefore, a summing up of the various points connected with the transmission of power by belting, a subject which has been in more or less of an unfinished or uncertain state.

The paper is published in this number of The Journal and contains valuable charts to assist in the solution of belting problems. Mr. Barth will use lantern slides to illustrate his paper. It is urged that any who have the results of practical experience to offer attend the meeting and contribute to the discussion.

THE ANNUAL MEETING

The twenty-ninth annual meeting of The American Society of Mechanical Engineers was held in the Engineering Societies Building December 1–4, with an attendance of 738 members, the largest in the history of the Society, and a total registration of 1048. This total is not as high as that of a year ago, but it actually represents a larger attendance since this year only those were registered as guests who were to participate in the social functions.

The meeting was noteworthy in several particulars. There were six professional sessions, one more than at any previous convention. One of these was a machine shop session which led to the first steps being taken toward the formation of a machine shop section. The subject of aëronautics was considered for the first time by an American national engineering society. On Tuesday evening, besides the President's address was the conferring of honorary membership upon Dr. John A. Brashear, followed by his delightful lecture upon A Journey Among the Stars. On Thursday evening was the intensely interesting lecture by Lieut. Frank P. Lahm on The Conquest of the Air.

OPENING SESSION, TUESDAY EVENING

The opening session of the convention is always an anticipated occasion. It is a social event where members first greet one another and is, moreover, the time for the delivery of the annual address of the President.

The session was called together by President M. L. Holman, who proceeded at once with his address. In view of the activity of the Society in the conservation movement and the participation by President Holman in the governors' meeting at Washington, his subject was very properly The Conservation Idea as Applied to The American Society of Mechanical Engineers. The address is printed in full in this number. It considers broadly questions related to the conservation of our resources, including health, food, land, forests, water and water power, coal and steam power, minerals, etc. It is held that the crucial test of the work of the engineer will be

found in the cost per unit of output and will be measured by the ability of the work designed by him to compete in markets of the world. He is interested as one of the producing class in the conservation of the materials of the country and likewise in the conservation of the results of his own labor. Engineering societies also must see that their returns are commensurate with the efforts expended.

Following the address, Mr. W. R. Warner, Chairman of the Committee appointed for the purpose, presented Dr. John A. Brashear for honorary membership, saying:

It is my privilege to present John Alfred Brashear, Sc.D., LL.D., F.R.A.S., Member of the Astronomical Societies of Great Britain, France and Belgium and of the American Philosophical Society; Past Chancellor of the University of Western Pennsylvania; Organizer of Carnegie Institute; Collaborator with Langley in devising and making the bolometer for measuring heat to 1/100 000 of a degree; Co-worker with Morley and Michaelson in constructing the interferometer which established wave lengths of light as the unit of linear measure; Maker of Astronomical Instruments of unequaled delicacy and precision, the spectroscope whereby Keeler discovered the constitution of Saturn's rings and Campbell the motion of the stars in the line of sight, and the spectroheliograph with which Hale has determined the constitution of the sun and analyzed its elements; Physicist, Astronomer, Educator, whose contributions to science and technical learning are surpassed in value only by his personal worth and greatness of soul, which have endeared him to all who know him.

Dr. Brashear is thus formally presented in order that he may receive from you the certificate of honorary membership in The American Society of Mechanical Engineers.

The President then replied: John Alfred Brashear, Eminent Engineer, Scientist, Astronomer, Educator, and Craftsman, the Society is proud to honor you with the distinction I am now to confer. The mechanical engineering profession recognizes your achievements in the production of parts of optical apparatus whose mechanical perfection has never been approached, and which it will be difficult to surpass. For these reasons, by the authority conferred upon me, I now advise you that you have been elected to Honorary Membership in The American Society of Mechanical Engineers, and to all the rights and privileges attaching to this distinction.

In Witness Whereof, will you accept at our hands the diploma of such membership.

Dr. Brashear had been invited to address the Society on A Journey Among the Stars, and his lecture followed. By way of introduction he said that no honor which had been conferred upon him came so close as that just given—an honor by men who know the worth of real work. There is something that draws men to one another which is elevating and ennobling to the man who loves his work for its own

sake. He said, "There is a beautiful adage that I learned long ago· It goes this way: 'What man is there, who, coming in contact with great souls, is not made happier and better thereby.' A drop of water on the leaf of a lotus glitters with the luster of a pearl. And so our deeds may be small, if they are only done in the right spirit."

The speaker then took his audience on a journey made possible only by the wonderful developments of stellar photography, since the camera alone can penetrate the universe and the infinite spaces beyond. The photographs which Dr. Brashear displayed appeared as wonderful as those shown by him at Detroit at the time of the Spring Meeting. Striking features of the lecture were the illustrations used to indicate the magnitude of the heavens and to show how the movement of stars is determined by means of the spectrum.

BUSINESS MEETING

On Wednesday morning was the annual business meeting and the first professional session. President Holman called the meeting to order and reminded those present that in view of the large number of papers to be presented at the various sessions, it might be necessary for the Chair to limit discussions upon papers to the time specified by the rules. He suggested, however, that as there were eight auditoriums in the building, it would be possible to hold simultaneous meetings if any considerable number of members desired to continue the discussion upon a given topic beyond the time alloted. This plan was actually carried out in order to extend the discussion upon the papers given on the following morning upon machine shop subjects. On the afternoon of that day there were three sessions in progress at one time.

The first order of business was the reading of the report of the Tellers of Election. There were 179 applicants for membership and 21 for advance in grade. These having been duly balloted for were declared elected and the names are to be published in the membership list of The Journal.

The following officers were declared elected for the succeeding year: President, Mr. Jesse M. Smith; Vice-Presidents, Mr. Geo. M. Bond, Prof. R. C. Carpenter, Mr. F. M. Whyte; Managers, Mr. H. L. Gantt, Mr. Will J. Sando, Mr. I. E. Moultrop; Treasurer, Maj. Wm. H. Wiley.

The newly elected President, Mr. Jesse M. Smith, was then escorted to the Chair and spoke briefly as follows:

The honor which you have conferred upon me I sincerely appreciate. I recognize also the great responsibility that comes with the honor. The influence of the Society in the advancement of engineering, must not only be maintained, but greatly extended. It will be my endeavor to conserve the best traditions of the Society and to aid in its taking a position still farther forward.

Were I to follow precedent I would say no more at this time; but there is a subject which seems to me of great importance to the future of the Society, which I would like briefly to call to your attention.

The prominent new feature of the constitution, under which theSociety has been operating for 5 years, is the formation of standing committees to foster, organize and direct its various activities. Each of these seven committees is composed of five members. One member retires at the end of each year and a new member is appointed by the President. Thus the committees, while permanent as organizations, are being constantly and automatically renewed as to personnel.

The Secretary of the Society is the secretary to the Council and also the secretary to each of the standing committees. Thus the membership, the Council, and the various committees are properly coördinated to work together in harmony for the advancement of the Society; each committee taking charge of, and being responsible for, the particular work assigned to it by the constitution. The function of each standing committee is to initiate, promote and organize the work given to it by the constitution and by-laws, subject to the approval of the Council.

It is evident that when all the committees are in full operation, the Secretary as the executive officer will be fully occupied in carrying out the various activities initiated and organized by these various standing committees. The Secretary should not be called upon to do work which properly belongs to the Committees, however willing he may be to do so.

The orderly and systematic work of the Secretary is of the greatest importance. Through the good work of his office, the membership, scattered over the world, receives prompt, accurate and full information of what the Society is doing for the advancement of engineering.

Great and important and good as may be the work of the Secretary, there is a greater and different work to be done by the standing committees; and it is their active work which will inspire greater activity among the membership of the Society.

These committees, when fully organized, will contain 35 men who should be selected from the membership because of their peculiar qualifications and fitness to do the special work required. They must be men who can and are willing to devote the necessary time to the work. These 35 men are officially called to places of honor. They should, and undoubtedly will, respond to the call with ardor, and with the determination to "set the pace" for the membership at large in the march forward. The success and influence of the Society should be in direct proportion to the number of men who are active in its welfare.

The good work of the standing committees is already well commenced, but it should be extended and expanded, and improved with the experience of years and by the infusion of new and young blood until each committee accomplishes its full function.

The best work done in the Society has been done by men inspired with love for the profession of engineering. Love for the Profession does not die. There are now, and always will be, in this Society men who are thus inspired. Let them

come forward and take up the work before them, or if they be diffident, let us seek them out and bring them forward.

Let the members of the committees bring their work up to such a high degree of excellence and efficiency, that a position on a standing committee of The American Society of Mechanical Engineers will be an honor which a rising engineer, who loves his profession, will wish to attain.

FIRST PROFESSIONAL PAPERS

After the remarks by the President-elect, came the two professional papers of the morning, the first one being The Engineer and the People—a Plan for a Larger Measure of Coöperation Between the Society and the General Public, by Morris Llewellyn Cooke, Philadelphia, Pa. This paper advocates a more direct interest by engineers in affairs affecting the public and a greater effort to enlighten the public as to the advantages and achievements of engineering. A corresponding change is already in progress in other professions which the engineering profession may well emulate. The author asked for the appointment of a standing committee to be known as the Committee on Relations with the Public.

This paper was largely discussed both by members of the Society and prominent men identified with other lines of activity. Among the latter who contributed written discussions were: Arthur T. Hadley, LL.D., President of Yale University; Talcott Williams, LL.D., Associate Editor, Philadelphia Press; Frank Miles Day, Architect; Hon. Geo. W. Guthrie, Mayor of Pittsburg; Arthur L. Church, Trustee of the University of Pennsylvania.

Mr. Ambrose Swasey offered the following resolution, which was seconded by Mr. Fred W. Taylor:

Resolved: That we recommend to the Council the appointment of a professional committee to advocate, consider and report on the methods whereby the Society may more directly coöperate with the public on engineering matters and on the general policy which should condone such coöperation.

The resolution was unanimously carried.

Prof. F. R. Hutton called attention, in connection with the recommendation of Mr. Cooke that a Committee on Relations with the Public should be created, that this would require an amendment to the Constitution. He therefore gave notice of the purpose to make such an amendment in accordance with the provision of she Constitution to Article C45 at the Spring meeting, at which such amendment can come up for discussion.

The second paper of the morning was by Major Geo. O. Squier

of the Signal Corps, U. S. A., on the Present Status of Military Aëronautics. This paper with its illustrations was published in full in the last number of The Journal and is a remarkably complete statement of the development of the leading types of air craft. It deals to a certain extent with the problems of design and gives dimensions of different dirigible balloons and aëroplanes, besides data upon the construction of these types of machines.

The paper was discussed by Dr. W. J. Humphreys of the Weather Bureau, who told about the relation of the winds to the problems of flying machines. Dr. John A. Brashear spoke feelingly of the early work of Professor Langley in the development of the aëroplane, and of the credit due to him for his accomplishments. He was followed by Geo. L. Fowler, who had been associated with Professor Langley and he gave a brief sketch of some of his interesting work.

WEDNESDAY AFTERNOON SESSION

The meeting was called to order by President Holman who requested Mr. Geo. R. Stetson to preside.

The first paper was upon A Method of Obtaining Ratios of Specific Heat of Vapors, by A. R. Dodge of Schenectady, N. Y. This outlines a method of obtaining the ratio of specific heat which does not involve the use of available steam tables nor a condition in which the steam is presumed to be without moisture or superheat. Tables of data are included. The paper was discussed by Dr. Harvey N. Davis, who said he had an opportunity to go over the data previous to the presentation of the paper in connection with some of his own work and believed the method of using the throttling calorimeter which Mr. Dodge had devised was a great advantage in technique in the measuring of superheat.

The next paper was by Dr. Harvey N. Davis, Cambridge, Mass., upon The Total Heat of Saturated Steam. It has, for some time, been suggested that Regnault's formula for the total heat of saturated steam is considerably in error. This conclusion is confirmed by computing the value from the results of various experimenters upon the specific heat of superheated steam. From their work Dr. Davis has deduced a formula which is believed to give much more accurate results. The paper was discussed by Prof. C. H. Peabody, Prof. R. C. H. Heck, Prof. Wm. D. Ennis. There was a contributed discussion by Prof. Lionel S. Marks.

Following these papers upon what may properly be classed as

engineering physics dealing with the refinements of engineering, were two papers by Mr. C. R. Weymouth of San Francisco, Cal., presenting important results in the line of engineering practice. These were presented for the author by Prof. D. S. Jacobus. The subjects were Fuel Economy Tests at a Large Oil Burning Electric Plant and Unnecessary Losses in Firing Fuel Oil. The first of these contains results of tests upon a 15 000 kw. power plant of the Pacific Light and Power Co., Redondo, Cal., having steam engine prime movers and using crude oil as fuel. The results were given for various uniform loads, ranging from 2000 to 5000 kw.; also for the entire station on a variable railway load.

The second paper describes apparatus for securing proper adjustments in automatic firing for steam boilers in plants burning liquid fuel. The paper also has valuable data upon the heat value of California oils.

These two papers were discussed by Prof. Wm. Kent, Prof. Wm. D. Ennis, J. R. Bibbins, I. E. Moultrop, A. H. Kreusi, Prof. I. N. Hollis, and by Geo. H. Barrus with a contributed discussion.

WEDNESDAY EVENING LECTURE

On Wednesday evening was the lecture on aëronautics by Lieut. Frank P. Lahm of the Signal Corps, U. S. Army, who took as his subject The Conquest of the Air. The interest aroused by this feature of the annual meeting is indicated by the size of the audience which greeted the speaker. It was the largest in the history of the Engineering Societies' Building. Every seat and the available standing room of the auditorium were taken and the evident anticipation of the audience changed to enthusiasm as the speaker skilfully developed his subject.

The lecture was illustrated by a profusion of lantern slides and by motion pictures of dirigible balloons and the Wright Brothers' aëroplane. The speaker traced the important events related to the development of air ships during the past 125 years, beginning with the discovery in France of the principle of the hot-air balloon by the Montgolfier brothers. Benjamin Franklin witnessed one of the earliest ascensions in France by hot-air balloon and is reported to have had faith in this type of craft. In reply to the question "Of what use are balloons?" he said "Of what use is a new-born babe?"

Lieutenant Lahm is an experienced balloonist and his graphic description of a balloon ascension was so evidently a recital of his own experiences as to add force to his remarks. He described the

process of preparing a balloon for ascension and inflating it and the instruments used by the aëronaut. To maintain equilibrium when a balloon is in the air requires close attention. A cloud passing across the sun cools the gas and starts the balloon down, or a burst of sunshine on a cloudy day produces the opposite effect. The cool air encountered in passing over a forest has the same effect as the cloud. The pilot must know at once when his balloon starts up or down. A little sand thrown out at the beginning of a descent will do more to stop it than a large quantity later. The registering barometer does not record quickly enough, so an aneroid barometer with a circular dial and a needle is used; or more often a statoscope, which indicates instantly whether a balloon is going up or down. A sextant with artificial horizon is used for finding the latitude of a balloon when above the clouds.

Answering the questions that are commonly asked about ballooning, the speaker said there is nothing by which one can measure his height, and there is no unpleasant motion as in an elevator. Suspended in the air and moving with it, one does not realize that he is moving at all. There is therefore no unpleasant sensation; the delights of ballooning can be realized in no other way; and at the conclusion of a trip the landing is made, the balloon shipped back to the starting point by freight or express, and "its passengers settle down comfortably to their dinner in the dining car and go over again the enjoyable incidents of the ascension."

Interest in aëronautics was greatly stimulated by the international competition for the Gordon Bennett Cup in 1906. This race was from Paris and was won, the speaker modestly said, by "an American." This race was with free balloons, but it is expected that dirigibles will enter future races.

Descriptions were given of representative dirigible balloons, beginning with that of Santos Dumont in 1898, who succeeded three years later in circling the Eiffel Tower in his balloon. Another early and successful airship was that built by the Frenchman Julliot, an engineer in the employ of Lebaudy brothers, wealthy sugar refiners in Paris, who backed him. His efforts finally led to the construction of the well-known *Patrie.* Many views were shown of the familiar war balloons of the various countries, including the *République, Ville de Parie, Gross, Parseval, Zeppelin* and the dirigibles of the British and American armies which bear numbers only in place of names.

Of greater interest than any of these, perhaps, was the account of

the Wellman airship designed for reaching the North Pole. It was built in Paris in 1906 and transported to Spitzburgen. It was designed as a weight carrier, with a speed of only 15 miles an hour, and would carry a crew of three men, dogs, sleds, boat, and abundant provisions. By taking advantage of favorable winds it was hoped to cover the 700 miles to the pole in two days. The return journey would be less difficult as any direction would lead back to civilization. In attempting its flight, however, bearings were lost and the ship had to be returned to its quarters.

In dealing with heavier-than-air machines prominence was given to the work of the Wright brothers, whose aëroplane at Fort Myer, Va., established so notable a record. Proper recognition was also given to the early work of Prof. Langley who, in 1896, constructed a model that flew a mile under steam power.

The culminating feature of the lecture was the moving pictures. Huge dirigible balloons were seen slowly moving out of their balloon houses and later returning. The Baldwin dirigible was shown in actual flight and then there were views of the rapidly moving Wright brothers' machine, which flitted across the screen like a great bird.

In conclusion the speaker said, "With dirigible balloons capable or remaining in the air 13 hours, covering a distance of 176 miles; with the Wright aëroplane which has already remained in the air an hour and a half and has carried two persons at the rate of 40 miles an hour, under the perfect control of its operator, I think it will be agreed that the experimental stage is past and the conquest of the air is a fact."

THURSDAY MORNING—MACHINE SHOP SESSION

The session on Thursday morning was devoted to papers upon machine shop practice. Vice-President Fred J. Miller presided.

The first paper was upon Efficiency Tests of Milling Machines and Milling Cutters, by A. L. DeLeeuw, Cincinnati, O. It pointed out the desirability of indicating the power of a machine tool by the amount of metal which it is capable of removing, rather than by the size of the driving pulley and belt. It described tests upon several milling machines for the purpose of ascertaining the amount of metal removed and the capacity; also the horsepower required under various conditions of feed and speed. It considered the mechanical efficiency of the machines and gave results of tests showing the importance of improvement in milling cutters.

The paper was discussed at length by Wilfred Lewis, who presented a discussion for himself and Wm. H. Taylor; by Fred J. Miller and Fred W. Taylor. There were discussions, also, by Prof. H. W. Hibbard and Prof. J. J. Flather.

The next paper was upon the Development of the High Speed Milling Cutter with Inserted Blades for High Speed Steel, by Wilfred Lewis and Wm. H. Taylor, both of Philadelphia, Pa. The milling cutter which formed the basis of this paper has inserted helical blades of high speed steel, mounted in a steel holder to give a solid backing for the blades on the driving side against which they are held by a soft metal filler on the opposite side. The cutting power of a cutter built up in this way is so great that it is stated to be beyond the capacity of any milling machine now on the market. Tables of results of tests were included in the paper. The discussion was by Fred J. Miller, Oberlin Smith, Fred W. Taylor, A. L. DeLeeuw, A. D. Carhart, Prof. R. T. Stewart, Webb J. Burkitt and Harrington Emerson.

Following these papers upon milling practice was one upon lathe tools by James Hartness, Springfield, Vt., entitled Metal Cutting Tools without Clearance. The tool operates on a new principle developed by the author which, contrary to the universal plan of cutting tools, was designed to be used without clearance. The tool is supported in a holder so constructed as to allow a slight oscillatory motion which permits the face of the tool to bear against the face of the metal from which the chip is being cut. This steadies the tool, prevents lateral vibration which is detrimental to the cutting edge of any tool and so permits a more acute cutting edge.

In presenting the paper, Mr. Hartness prefaced the reading by remarks upon the use of lubricants, stating that it was necessary in certain cutting operations to use lard oil. The paper was discussed by Henry Harrison Suplee who mentioned that he had used wood cutting tools without clearance in planing machines for much the same purpose as Mr. Hartness used his metal cutting tool without clearance. The objection for that class of work, however, had been the heating of the cutting edges.

The last two papers were upon the subject of gearing which in this instance, as in times past, proved to be most prolific of discussion. The first paper entitled Interchangeable Involute Gear Tooth Systems, by Ralph E. Flanders of New York, showed the effect of varying the pressure angle and height of addendum on the various practical qualities of gearing, such as continuous action, side pressure, strength,

efficiency, etc. The author asked that the question be discussed of a Committee to investigate and report to the Society on the wisdom of an alternative form of gearing for heavy use. The first discussion was by Wilfred Lewis, who advocated the investigation of the subject and made the following motion:

"I would therefore propose that this subject be referred, as Mr. Flanders suggested, to a committeé of this Society to investigate and report upon the adoption of a standard system of involute gearing. The paper covers the case from a 12-tooth pinion to a rack. That is as far as I would go with such a system. If internal gears are employed, that would be understood to be more or less special."

This paper was very much discussed, the following contributing discussions: Wilfred Lewis, Luther D. Burlingame, D. F. Nisbet, Chas. W. Hunt, Oberlin Smith, Prof. F. R. Hutton, Prof. F. de R. Furman, A. L. DeLeeuw, Elmer H. Neff. There were also contributed discussions by Lewis Sanders, E. R. Fellows, John C. Fawcus, Frank Burgess.

The second paper upon gearing was upon Spur Gearing on Heavy Railway Motor Equipments, by Norman Litchfield, New York. This dealt with the breakage of gearing in heavy electric railway service and referred to the work of the Interborough Rapid Transit Co. in overcoming this difficulty. It considered the materials and design of gearing for heavy duty including the shape of tooth outlines employed. The discussion upon Mr. Litchfield's paper was all written, submitted by the following: F. V. Henshaw, John Thomson, J. Kissick, Jr., Geo. W. Sargent, Prof. F. de R. Furman.

The discussion upon the gearing papers was so extended that the session adjourned until afternoon, at which time Prof W. Rautenstrauch presided.

At this session the resolution offered by Mr. Lewis in the morning calling for the appointment of a committee to consider the matter of interchangeable involute gearing was brought up and unanimously carried. In order to conform to the usual procedure in such matters it was suggested by Mr. Elmer H. Neff that the resolution should be in the form of a request to the Council to take up the matter, which was concurred in by Mr. Lewis.

THURSDAY AFTERNOON SESSION

Prof. F. R. Hutton, who acted as Chairman, announced that the paper by Mr. Mellin upon Articulated Compound Locomotives would

be deferred until later in the afternoon when the lantern slides would be more effective.

The first paper to be presented was upon Liquid Tachometers, by Amasa Trowbridge, Hartford, Conn. This described the Veeder liquid tachometer and methods used in testing and calibrating it. It was discussed by H. H. Wait and H. G. Reist.

The next paper, by H. L. Gantt, Pawtucket, R. I., upon Training Workmen in Habits of Industry and Coöperation, drew out the most active discussion of any paper of the convention. It emphasized the fact that with the advent of the scientifically educated engineer capable of substituting a scientific solution of problems for the empirical solution of the mechanic, the responsibility of training workers actually shifts to his shoulders. If he properly conducts this training along the lines of scientific investigation efficiency of the workmen can be so greatly increased that the employer can afford to pay far in excess of the compensation usually allowed.

The discussion was very favorable to the contentions of Mr. Gantt, the idea being expressed that they represented humanitarian ideas rather than the purely commercial aspect so often predominating in the training of workmen. Oral or written discussions were contributed by the following: Dr. Rudolph Roesler, W. E. Hall, Charles Piez, Lewis Sanders, H. V. R. Scheel, H. K. Hathaway, T. Kelly, C. N. Lauer, J. C. Jurgensen, Harrington Emerson, Milton P. Higgins, Prof. Wm. Kent, Albert H. Emery, Jas. M. Dodge, Frank A. Haughton, C. H. Buckley.

Geo. B. Willcox of Saginaw, Mich., next presented a paper on Salt Manufacture, in which he described apparatus used in the manufacture of salt by the grainer process including the design of evaporated grainers built of reinforced concrete, and devices for handling and conveying salt and loading salt barrels into cars. There was a contributed discussion by C. F. Hutchings.

The next paper, upon Industrial Photography, by S. Ashton Hand, Cleveland, O., was illustrated by lantern slides showing some remarkably perfect results obtained in photographing machinery and interior of shops. These illustrated methods used by the author in bringing out details and avoiding shadows or too prominent high lights. He showed by a series of plates results that could be obtained in developing plates that were under or over-exposed; the effect of different lengths of exposure upon plates and how certain defects in plates could be remedied. This was discussed by the following: C. J. H. Woodbury, Henry T. Binsse, Charles W. Hunt, H. H. Suplee, Ambrose Swasey.

The paper upon Articulated Compound Locomotives by C. J. Mellin, Schenectady, New York, which had been deferred until the end of the meeting, described locomotives articulated by the Mallet method by means of which the tractive power can be doubled over that of an ordinary engine for a given weight of rail with a substantial saving in fuel. A very full discussion of the paper was offered by F. J. Cole, and S. M. Vauclain presented a discussion illustrated by a number of lantern slides. Other discussions were offered by Harrington Emerson, L. R. Pomeroy, Geo. L. Fowler, Geo. R. Henderson, Alfred Lovell.

GAS POWER MEETING

The Gas Power Section held a meeting on Thursday afternoon, Dr. Charles E. Lucke in the chair, and about 150 members of the section present.

The executive committee of the section reported that it had proceeded to the election of officers for the ensuing year, as follows:

Chairman, F. R. Low; Secretary, George A. Orrok; Chairman of the Membership Committee, Robert T. Lozier; Chairman of the Meetings Committee, Cecil P. Poole; Executive Committee, F. H. Stillman, George I. Rockwood, R. H. Fernald, F. R. Hutton, H. H. Suplee.

The retiring executive committee recommended the appointment of a nominating committee, to place at least two candidates in nomination for each office; a committee on installations, to keep up a list of all power plants; and giving complete data as to equipment; a committee on plant operation, to collect information as to load characteristics, costs of operation, behavior of apparatus, etc., and a committee on breakdowns, failures, etc., to collect and file information as to accidents, unsatisfactory operation, etc.

In connection with the work of the standardization committee a communication from Professor Lionel S. Marks was presented by Professor Ira S. Hollis, discussing the high and low heat values, and calling attention to the fact that the "effective" heat value in German practice is the heat value of the gas under the conditions of temperature and pressure at which it is used.

An interesting paper was presented by Mr. L. H. Nash, reviewing his own experiences in gas-engine work, and showing the extent to which old ideas have cropped up from time to time. This paper, which was profusely illustrated by lantern slides, was most interest-

ing and instructive. A paper upon Some Possibilities of the Gasolene Turbine, by Prof. Frank C. Wagner, was read in abstract, in the absence of the author. This paper discussed analytically the relative effects of an excess of air, or an injection of water for keeping down the temperature of the gases.

Dr. Lucke called attention to the observed facts as to the behavior of the free expansion of gases in nozzles, showing that assumed effects are not realized in practice, and recommended further experimentation in this direction.

THURSDAY EVENING RECEPTION

On Thursday evening was the Annual reception which this year was held in the rooms of the Society, and followed by the collation on the sixth floor and dancing on the seventh floor of the Engineering Societies Building.

FRIDAY MORNING SESSION

The papers for Friday morning presented mainly the results of tests upon various types of apparatus. The first by Prof. R. T. Stewart of Pittsburg, Pa., was one of a series of papers which he has read before this Society upon extended lines of investigation which he has conducted. This paper dealt with the Physical Properties of Carbonic Acid and the Conditions of its Economic Storage for Transportation. It treated exhaustively of the physical properties of carbonic acid, and mentioned tables of data heretofore unavailable. There was also a discussion of the design of cylinders to withstand high pressures. The discussion on the paper was, from the nature of the subject, somewhat out of the sphere of mechanical engineering and bore largely upon the safety of carbonic acid cylinders used for the storage transportation of a chemical. The following offered discussions: John C. Minor, Jr., H. E. Sturcke, Graham Clarke, L. H. Thullen, E. D. Meier, Sanford A. Moss.

The Slipping Point of Rolled Boiler Tube Joints, by Professors O. P. Hood and G. L. Christensen, Houghton, Mich., was the title of the next paper which had for its object the recording of data regarding the behavior of joints made by rolling boiler tubes into the containing holes of the tube sheets. Discussion was offered by J. C. Parker, C. H. Benjamin, E. D. Meier, M. W. Sewall, F. W. O'Neil.

The third paper by Prof. R. G. Dukes on Tests on Friction Clutches for Power Transmission gave results of tests upon friction clutches

of different makes and was discussed by the following: Geo. N. Van Derhoef, P. E. Welton.

The final paper of the morning was a brief description with the theory of the design of An Averaging Instrument for Polar Diagrams, by Prof. W. F. Durand, Stanford University, Cal. It was intended to supply information for the design of the planimeter for use on polar diagrams so commonly used on different types of recording instruments.

The meeting closed with the following resolutions:

WHEREAS: The American Society of Mechanical Engineers at their Annual Meeting, December, 1908, desires to express its appreciation to those who have provided opportunities for entertainment; and on behalf of its visiting members thanks for the welcome so cordially given by the local members and their friends of New York and vicinity.

Be it Resolved, that the Secretary be instructed to extend the thanks of the Society and to express the appreciation of its members and guests to the local committees for their untiring efforts; to those who have sent invitations to visit engineering works and places of interest; to Professor Brashear for his delightful lecture; to Brig. Gen. James Allen and his associates of the Signal Corps for the remarkable presentation of Aëronautics before the Society; and especially to the ladies who extended so generous a hospitality to their guests.

THE NEW PRESIDENT OF THE A. S. M. E.

Mr. Jesse M. Smith, the President of the Society for 1909, was born in Newark, Ohio, in 1848. He moved to Detroit, Michigan, with his father's family in 1862. In 1865 he entered Rensselaer Polytechnic Institute, Troy, New York, remaining there three years. The following year he spent traveling in Europe, and entered L'École Centrale des Arts et Manufactures, Paris, France, receiving the degree of M.E. in 1872. During his vacations, he traveled among the manufacturing plants of France, Germany and Belgium and attended lectures in the Polytechnic Institute in Berlin. After graduation in Paris he traveled three months among the iron and machine works of England.

He began the practice of engineering in 1873, designing and superintending the erection of blast furnaces for smelting iron from native ores with raw bituminous coal in the Hocking Valley, Ohio. He made surveys of coal mines, opened mines and built coal handling machinery for them. He surveyed and constructed railroads from mines to furnaces.

Upon the death of his father, in 1880, Mr. Smith returned to Detroit and opened an office as Consulting Engineer. He designed and constructed a high speed center crank steam engine with shaft governor,

containing the feature of the modern inertia weight governor, and put it in operation driving a Brush dynamo producing 40 arc lights in 1883, and in 1890 he presented a paper before the Society on this governor.

He represented the United States Electric Lighting Company in Ohio and Michigan 1884 to 1886—during which time he erected a number of the early incandescent electric light plants, including one of 1000-light in the Stillman Hotel, Cleveland, Ohio, which was the first hotel lighted exclusively and continuously by electricity from its own plants. He returned to the work of Consulting Engineer in 1886 and continued in it until 1898. During this time he designed and erected several power plants and several plants for electric lighting and electric railways; also apparatus for steam heating with exhaust steam in several large manufacturing plants.

He began in 1883 to be called as an expert witness in the U. S. Courts in patent litigation. This practice gradually grew and displaced the work of consulting engineer until 1898, when he moved to New York to continue the practice of expert in patent causes exclusively.

Among the notable cases in which he acted as expert were: steam injectors under the Hancock Inspirator patents; cylinder lubricators for locomotives; roller mills and middlings purifiers for flour manufacture; cyclone dust collectors; quick action air brakes under Westinghouse patents; pneumatic tires for automobiles; automobiles under the Selden patent; induction electric motors under Tesla patents; pressure filters; incandescent electric lamps; steam heating apparatus; typewriters; armored concrete construction; the calculagraph, etc.

He became a member of this Society in 1883 and was a member of the Council as Manager 1891 to 1894, and Vice-President 1894 to 1896, and 1899 to 1901.

He is a member of the American Institute of Electrical Engineers; La Société des Ingenieurs Civils de France; l'Association des Anciens Elèves de l'École Centrale des Arts et Manufactures; The Detroit Engineering Society; the Society for the Advancement of Science; the American Geographical Society; the Engineers' Club and the Ohio Society of New York.

CONVENTION NOTES

The members of the Local Committee of which Mr. H. F. Holloway was Chairman and the Ladies' Reception Committee, Mrs. Jesse M.

Smith, Chairman, did most effective work in providing for the welfare of the members and guests in attendance at the Convention. Both committees were divided into sub-committees to more effectually look after the varied interests for which it is necessary to provide in a large gathering of this kind.

A different reception committee was assigned to each morning, afternoon and evening during the convention, to promote sociability among the members and give any information desired. This plan added much to the enjoyment of the gathering in the foyer on the first floor, which really became the social place of the convention.

The Hotel Committee, D. H. Gildersleeve, Chairman, supplied those at the different hotels with the names of guests attending the convention and the hotels at which they were stopping.

The Council room in the Society's offices on the eleventh floor was used as headquarters for the ladies and afternoon tea was served. Members of the ladies committee were in attendance and the various excursions provided for the ladies were started from this point.

A new plan of registration was adopted this year which greatly favored registering. Each member was assigned a number in advance, the arrangement being an alphabetical one. This enabled the division of the list of members into three sections so that three lines of members could be registered simultaneously. Registration blanks were printed in advance with name and home address so that all the member had to do was to add his local hotel address. When a member registered he gave his name and received at once an envelope containing his badge and a filled out registration blank. In this way there were no delays incident to registration.

EXCURSIONS

A large number of excursions were arranged for the visitors through the untiring efforts of the Excursion Committee, Jas. V. V. Colwell, Chairman. Invitations were received to visit the following engineering works and plants, to each of which and their representatives, the thanks of the Society have been gratefully extended.

Pennsylvania Tunnels: Invitation by Alfred Noble, member of the Society; Manhattan Rubber Manufacturing Company, Passaic, N. J., by A. F. Townsend, President; Deep-Water Terminal, Pennsylvania R. R., by F. L. DuBosque, member of the Society; N. Y. Central & Hudson River R. R. Port Morris Power station, by E. B. Katte member of the Society; Goldschmidt-Thermit Co., by W. R. Hulbert,

member of the Society; High-Pressure Fire Service, by I. M. de Varona, Chief Engineer of the Department of Water Supply, Gas and Electricity; Waterside Stations, No. 1 and 2, New York Edison Co., by New York Edison Co.; Joseph Dixon Crucible Company, by Joseph Dixon Co., George E. Long, Treasurer, Jersey City, N. J.; The American Manufacturing Co., by The American Manufacturing Co., Anderson Gratz, President; The J. H. Williams Co., by J. H. Williams Co., Brooklyn, N. Y., J. H. Williams, President; Queensboro Bridge (Blackwell's Island Bridge), hy the Commissioner, James W. Stevenson; Atha Tool Co., Newark, N. J., by Harry Atha, Treasurer; Swift & Company, by M. F. Mallon, Chief Engineer; Singer Tower and Power Plant, by Singer Manufacturing Co., E. P. Coleman, Secretary; Trenton Iron Co., Trenton, N. J., by Trenton Iron Co.; Brooklyn Navy Yard, by Admiral Caspar F. Goodrich, Commandant; John Thomson Press Co., Long Island City, by John Thomson, President; Metropolitan Tower and Power Plant, by Metropolitan Life Insurance Co.; Interborough Rapid Transit Co., 59th St. Power Plant, by Interborough Rapid Transit Co.; Manhattan Bridge, by Glendon Contracting Co., The Crocker-Wheeler Co., by Gans S. Drum, Vice-President.

Every possible courtesy was extended and in a number of cases, where a party was large, special transportation facilities were provided, luncheons served, and opportunity afforded for inspecting the apparatus and machinery. These parties were conducted by local members of the Society who generously volunteered their time and services. The Information Bureau conducted in the foyer of the Engineering Societies Building, Albert Spies, Chairman, was of material assistance in carrying out the excursions.

Excursions provided by the Ladies' Reception Committee, Mrs. Jesse M. Smith, Chairman, were also successfully carried out and several ladies served most efficiently as guides to points of interest about the city. Especially enjoyable were the automobile drives, afforded by Mrs. J. A. Kinkead.

DECEMBER MEETINGS OF THE COUNCIL

The regular meeting of the Council was held Tuesday, December 1, 1908, in the rooms of the Society.

There were present, Pres. M. L. Holman, in the Chair, Messrs. Breckenridge, Gates, Dodge, Fritz, Hutton, Hunt, Swasey, Stott, Taylor, Wellman, Wiley, and the Secretary.

The death of Mr. E. G. Eberhardt was reported.

In connection with the death of Mr. Herbert D. Hale, architect of the Engineering Societies Building, the Honorary Secretary was directed to draw up resolutions as expressing the sentiment of the Council.

The resignation of Louis Schaeffer was reported.

It was voted to grant to recognized book dealers a discount of 25 per cent from the price to non-members of the Society's publications.

The annual reports of Standing Committees to the Council were published in the December Journal.

The Committee on International Screw Threads reported a conference with the representative of the Society in Paris, Mr. Laurence V. Benet.

The Committee on the Land and Building Fund reported gifts of $1000 each from Mr. Worcester R. Warner and Mr. Ambrose Swasey.

The Secretary read a letter from President-Elect Taft, expressing his regret at being unable to attend the Annual meeting of the Society and participate in the discussion of the paper on "The Engineer and the People."

The Council directed that the invitation from the Government to participate in the National Conservation Commission Congress held in Washington, December 8, be accepted and the representatives notified.

Dr. W. F. M. Goss of the Government Advisory Board on Fuels and Structural Materials met with the Council. He was invited to be present at a later meeting together with the other members of the Committee.

Special Meeting of the Council

Continued from the regular meeting, December 1

A meeting of the Council was held on Friday, December 4, in the Council room of the Society.

There were present: Messrs. Holman, Bond, Breckenridge, Carpenter, Dodge, Hunt, Humphreys, Hutton, Gantt, Miller, Moultrop, Smith, Swasey, Taylor, Wellman, Whyte, Wiley, and the Secretary.

The meeting was called to order by Mr. Holman, the retiring President, who called Mr. Jesse M. Smith to the chair.

The Secretary thereupon retired, and Professor Breckenridge was made Secretary *pro tem.* The following resolutions were recorded:

Voted, that Mr. Calvin W. Rice be reëlected Secretary on the same terms and conditions as last year.

Voted that Prof. F. R. Hutton be reëlected Honorary Secretary on the same terms and conditions as last year.

The resignation of H. S. Richardson was accepted.

The rules governing Student Membership in the Society, prepared by a committee of the Council, were approved and ordered enforced.

Mr. Charles Wallace Hunt was named as the representative of this Society on the John Fritz Medal Committee upon the expiration of the term of office of Prof. John E. Sweet in January 1909.

Mr. Fred J. Miller was named as the representative of the Society on the Board of Trustees of the United Engineering Society.

The following resolutions were referred from the annual convention:

That the President of the Society be and hereby is authorized to appoint a committee of seven members to memorialize Congress to authorize the purchase and erection of a large testing machine for the government and to state what size and quality of machine should in their judgment be purchased.

That the Council be hereby requested to appoint a committee to investigate and report upon the adoption of standard systems of interchangeable involute gearing from 12-tooth pinions to racks.

A resolution was presented from the Aëro Club and from Mr. A. F. Zahm, Secretary of the International Aëronautical Conference at New York to the effect that The American Society of Mechanical Engineers request the President of the United States to call the attention of Congress to the advisability of providing the military departments of the Government with funds sufficient to establish aëronautic plants, proportionate to those of other nations.

The foregoing resolutions were laid on the table.

NATIONAL CONSERVATION CONGRESS

The Second Conservation Congress was held in Washington, D. C., December 8–10, to receive the report of the National Conservation Commission appointed by the President of the United States at the initial Conservation Congress of the Governors of all the states held in Washington last May.

There were present, besides the President and President-elect, the Governors of thirty-nine States, or their representatives; Senators and Representatives of various states; representatives of the largest commercial bodies and labor organizations and from railroads and the world of capital, as well as the national engineering societies. The delegates from this Society were Mr. Jesse M. Smith, President; and Prof. Geo. F. Swain, Messrs. L. D. Burlingame, Charles Whiting Baker and Calvin W. Rice, members of the Society's Conservation Committee. The Society was also represented by Mr. John R. Freeman, who, together with Professor Swain and Mr. Charles T. Main, was appointed by the Council of the Society upon an Advisory Board to the Committee on the Valuing of Water Powers, in response to a special invitation from the Government.

The meeting was opened by the Hon. Gifford Pinchot, with prayer by the Rev. Edward Everett Hale. President Roosevelt was the first speaker.

OPENING ADDRESS BY PRESIDENT ROOSEVELT

President Roosevelt in his address briefly reviewed the beginnings of the movement toward conservation, which resulted in the appointment of a National Conservation Commission whose inventory of the national resources of the country this congress has convened to receive. He advised the immediate beginning of the construction of waterways, for which plans have already been approved, and warned against the policy of procrastination, delay and partial action which have wasted vast expenditures in the past. He advocated the issue of bonds if the cost could not be paid immediately from the current revenues. He advised that the matter be approached from the view of national interest under the guidance of the wisest experts in engineering, in transportation, and in all the uses of our streams;

and advocated immediate measures for forest protection and the securing of the Appalachian and White Mountain national forests without delay.

The President spoke with great appreciation of the work of the "two great" national engineering societies, commending their hearty spirit of coöperation and promptness of attack. The participation of this Society in the enduring work of conservation was thus definitely recognized.

Prominent among the points emphasized by the President was that our country is the first to make an inventory of its natural resources. These inventories corroborate the estimates made at the first Conference that certain resources are about to be exhausted, and that therefore the creation of public sentiment and the consequent action toward conservation is most timely.

The President emphasized the effect which the conservation of forests has on the flow of streams. This theory is also supported by the Hon. Gifford Pinchot, Chief Forester of the United States, whose scientific investigation and application of his principles to practical conservation, wherever possible, have won for him the high regard of the country.

President Roosevelt again emphasizes this point in his message to Congress, supplying photographs and giving information in regard to parts of China and other countries from which the timber had been removed, leaving country once densely populated a barren waste supporting no life.

Governor Chamberlain of Oregon cited the Government's authority and jurisdiction over the undisposed portions of the public domain, and said that the power of Congress is there unquestionably supreme with respect to the soil, the mines, the forest, and the streams tributary to navigation.

President-elect Taft, who also addressed the Congress, said that the Constitution should be construed to give large powers to conservation because, to be effective, it must cover the whole country. It is necessary to nationalize the work of conservation, as no one State is financially equal to carrying out an adequate conservation policy. Mr. Taft agreed with President Roosevelt about the issuance of federal bonds for the funding of permanent national improvements.

REPORT OF THE CONSERVATION COMMISSION

The report of the Commission included recommendations for the enactment of such laws as may be necessary to extend coöperation,

and for the policy of the separate disposal of surface, timber and mineral rights remaining on public lands.

The Conference approved the disposal of mineral rights by lease only, and the disposal of timber rights only under conditions insuring proper cutting and logging.

Its policies in regard to waterways favor treating all portions of each waterway as inter-related, and recommend federal appropriation or the issue of bonds for the development of navigation, water supply and other state uses.

A resolution was adopted providing for the appointment of a joint Committee of State and National Commissions to prepare a plan for united action by all the organizations concerned.

REPORT ON FORESTS

The partial inventory of the forests of the United States was presented by Senator Reed Smoot of Utah, Chairman of the Section of Forests.

The report said in part:

Our forests now cover 550 000 000 acres, or about one-fourth of the United States. The original forests covered not less than 850 000 000.

We take yearly, including waste in logging and in manufacture, and not counting loss by fire, 23 000 000 000 cu. ft. of wood from our forests, which is 3½ times their yearly growth..

Under right management our forests will yield more than four times as much as now. We can reduce waste in the woods and in the mill at least one-third with present as well as future profit: We can perpetuate the naval stores industry. Preservative treatment will reduce by one-fifth the quantity of timber used in the water or in the ground. We can practically stop forest fires at a total yearly cost of one-fifth the value of the standing timber burned each year, not counting young growth. We shall suffer for timber to meet our needs until our forests have had time to grow again. But if we act vigorously and at once we shall escape permanent timber scarcity.

REPORT ON WATERWAYS

The report of the Section of Waters was in part as follows:

It has been roughly estimated that the inland waterways of the country could be improved in ten years at a cost of $50 000 000 annually in such manner as to promote inter-State commerce and at the same time greatly reduce the waste and extend the use of the waters.

There are in mainland United States 282 streams navigated for an aggregate of 26 115 miles, and as much more navigable by improvement; there are also forty-five canals, with a mileage of 2189.05, besides numerous abandoned canals. On lake and sound routes there is large traffic, but the navigation of rivers and

canals is too small for definite record. The cost of water carriage averaging about one-fourth that of rail carriage, and our railway freightage during 1906 reaching 217 000 000 000 ton miles, at an average rate of 0.77 cent, the shipping of one-fifth of our freight by water would have saved more than $250 000 000 to our producers and consumers.

The theoretical power of the streams is more than 230 000 000 horse power; the amount now in use is 5 250 000 horse power. The amount available at a cost comparable with that of steam installation is estimated at 37 000 000 horse-power, and the amount available at reasonable cost at 75 000 000 to 150 000 000 horse power. The 37 000 000 horse power exceeds our entire mechanical power now in use, and would operate every mill, drive every spindle, propel every train and boat and light every city, town and village in the country.

The broad plan already framed by statesmen and experts and approved by the Executive should be enacted into law; it provides for a system of waterway improvement extending to all of the uses of the waters and benefits to be derived from their control, including the clarification of the water and the abatement of floods for the benefit of navigation, the extension of irrigation, the development and application of power, the prevention of soil wash, the purification of streams for water supply and the drainage and utilization of the waters for swamp and overflow lands.

REPORT ON MINERALS

The report of the Minerals Section to the National Conservation Commission, of which Representative John Dalzell is Chairman, was presented. It is in part, as follows:

One-half of the natural gas now coming out of the earth, about 1 000 000 000 cu. ft. per day, or more than enough to light all the cities of the United States having more than 100 000 population, is wasted by being allowed to escape with the atmosphere. This entire waste can be prevented by adequate state legislation.

The waste in coal mining is equivalent to about one-half of the total product mined, or for the year 1907, 240 000 000 tons. The aggregate waste in mining coal, lead, zinc, copper, gold and silver for the past year is estimated to approximate $1 000 000 per day in value.

Even more serious than the waste of materials is the excessive loss of life in mining operations. During the past year in the coal mines alone more than 3000 men were killed and more than 7000 injured, and the number of men killed for the number employed in the United States, is from two to four times as great as in other coal-mining countries.

The known coal supply occupies an aggregate area of nearly 500 000 sq. miles, and is estimated to contain about 1 400 000 000 000 tons of accessible coal. This supply is estimated to last until the middle of the next century.

The known iron ore supply is estimated at 3 840 000 000 tons. At the present increasing rate of consumption, it will have been consumed by the middle of the present century.

The chief waste in our oil supplies is in their misuse for fuel purposes where coal, a more abundant fuel, might be appropriately used.

Definite estimates of the supply of copper, lead, zinc, and the precious metals cannot be made, but judging from the present supply, they will scarcely last beyond the present century.

The close of the Conference marked the first milestone in the definite effort to conserve for posterity the resources which until recently the unthinking have regarded as exhaustless. The part of the engineer in this important work is evident. To him it is given to execute. The true executive is the leader, and let the profession become alive to the possibilities which this new movement affords.

Mr. Carnegie in his address at the second annual banquet of the Engineers' Club impressed the need of definite action in the conservation movement by the Engineering Societies.

Annual Meeting of the Rivers and Harbors Congress

The plan for the issuance of $500 000 000 of government bonds for improvements of the rivers, harbors and canals of the country met with general approval at the Rivers and Harbors Congress held in Washington, December 9, 10 and 11.

Important personages in public, industrial and commercial life of the nation participated in the proceedings, among whom the following addressed the congress: Vice-President Fairbanks, Andrew Carnegie, James Bryce, the British Ambassador; ex-Mayor Seth Low, of New York; Representative Joseph E. Ransdell; Champ Clark of Missouri, minority leader of the House of Representatives; Governor George E. Chamberlain of Oregon, Governor J. Y. Sanders of Louisiana, Samuel Gompers, president of the American Federation of Labor; Judge George Hillyer, a member of the Georgia Railroad Commission, and Professor W. D. Lyman, of Whitman College, of Washington.

Vice-President Fairbanks, in extending to the Congress a cordial welcome to Washington, said that the time has arrived when we must give to the subject of obtaining adequate transportation facilities at a minimum cost intelligent and effective consideration.

Ambassador Bryce spoke of the waterways of England, and especially directed the attention of Americans to the splendid system of internal navigation of Germany.

Representative Ransdell, President of the Congress, advocated vigorous efforts to secure the prompt passage of a large river and harbor bill at this session of Congress, and the committal, on the

part of Congress, to a broad, liberal policy of waterway improvement and legislation providing for their equitable administration.

Andrew Carnegie made an address in which he warned the delegates against the considerat'on of sectional projects, insisting that projects national in their scope are what is wanted.

Delegates to the Congress from New York State formed a New York State Waterways Association, to aid in the improvement of rivers and harbors of New York and of the country generally.

GENERAL NOTES

SUPPLEMENT TO THE JANUARY JOURNAL

With this number of The Journal is issued a supplement containing portraits of officers, officers and committees, charter, constitution and rules, periodicals in the engineering societies' library, membership lists, information upon the gas power section, new members elected, and related matter. Heretofore it has been customary to publish this material as a part of the January Journal at the beginning of the new year, following the election of new members, the appointment of officers and committees, etc. For greater convenience and in order to save time in publication, this material is, this year, issued as a supplement to The Journal for January. This enables us to publish a more complete list of new members, lists of committees and officers, a comprehensive list of periodicals in the Library, and the latest changes and additions made in the rules for the government of the Society.

THE ORGANIZATION OF STUDENT SECTIONS

The Society is pleased to announce the organization of two affiliated branches, one among the students at Stevens Institute, Hoboken, N. J., and the other at Sibley College, Cornell University, Ithaca, N. Y.

In order to provide for the affiliation of student organizations rules have been adopted in addition to those heretofore enacted for the guidance and organization of branches. These appear in the supplement to this number of The Journal and are most liberal in their provisions.

It is the desire of the Council to offer every inducement to young men about to enter the engineering profession to become associated with those actively engaged in successful engineering work and with engineers of prominence; and to supply them with the literature of the Society on the most liberal terms possible. The charge to members of student affiliated societies will be considerably less than the actual cost of the publications of the Society which are supplied them. Besides this opportunity of securing matter of so great an

educational value, there are the advantages mentioned of association with a body of established engineering reputation.

The distinction of being the first student branch of the Society belongs to the Stevens Engineering Society of Stevens Institute, Hoboken, N. J. A new Constitution has been drafted by them to include the larger scope of the Engineering Society and at a meeting on November 21 the requirements for student branches were taken up for discussion and accepted. Dr. Alexander C. Humphreys was nominated as Honorary President, in accordance with the provisions. Under the new arrangement this society retains its own identity and is still controlled by student officers under the direction of its Honorary President.

At a meeting at Sibley College, Cornell University, on December 9, the first steps were taken toward the organization of a Cornell Student Branch of the Society. Prof. R. C. Carpenter was chosen Honorary President, and an executive committee was appointed consisting of Profs. D. S. Kimball, H. Diederichs, and W. N. Barnard. Prof. C. F. Hushfeld was elected corresponding secretary. The meeting was attended by the following members of the Society: W. N. Barnard, R. C. Carpenter, G. D. Conlee, H. Diederichs, H. D. Hess, H. Wade Hibbard, C. F. Hirshfeld, D. S. Kimball and R. L. Shipman. As soon as possible the organization of the student membership of the branch will be completed and by-laws are now being drawn up by the Executive Committee.

LOST ARTICLES

Any one losing articles at the Reception Thursday evening of the Annual Convention should communicate with the Secretary. A few small articles were found which we are anxious to return to the owners.

TABLET IN HONOR OF ANDRE-MARIE AMPERE

The Society was invited to be present at the unveiling of a bronze and tile memorial tablet in honor of the French scientist Andre-Marie Ampere which was set up in the Lackawanna railroad station at Ampere, N. J., by Dr. Schuyler Skaats Wheeler, Past President A. I. E. E. The memorial was unveiled December 3 by his Excellency M. Jusserand, the French Ambassador.

Andre-Marie Ampere, who founded the science of electro-dynamics, and whose name is used throughout the world to designate the unit of electric current, was born at Lyons 1775 and died at Marseilles 1836.

FOREST FESTIVAL OF THE BILTMORE ESTATE

Reforestation, which is second in importance only to the preservation of forests, has been brought to a successful stage of development on the Biltmore Estate at Biltmore, N. C.

A "Forest Festival" was held Nov. 26–28 when visitors were conducted over the estate, and the growth of the forests planted between 1889 and the present date reviewed. The Biltmore Estate, under the direction of Dr. C. A. Schenck, Chief Forester, and Charles A. Waddell, Engineer, Mem. Am. Soc. M. E., has taken the lead of forestry in America. Dr. Schenck stated to the guests that forestry on the estate had been profitable.

Mr. Charles E. Waddell was appointed Honorary Vice-President for this occasion to represent the Society. At the dinner on November 27, Mr. Waddell, as the engineer of the Biltmore Estate, extended a welcome to the visitors, and as representative of the Society extended the Society's cordial and fraternal greetings. He spoke of the Society's interest in conservation, and touched upon its participation in the conservation movement and mentioned that the Society has been requested by the Government to appoint a special advisory board to the National Conservation Commission.

INVITATION FROM THE ENGINEERS' CLUB OF TORONTO

The Engineers' Club of Toronto, Canada, has extended to the members of the Society, when visiting in Toronto, the privileges of the club rooms. The Society reciprocates by offering the courtesies and conveniences of the Society rooms to visiting members of the Toronto Club.

INSTITUTE OF MINING ENGINEERS

An invitation has been extended to the members of the Society by the American Institute of Mining Engineers, to attend the annual meeting of the Institute at New Haven, Conn., which begins on Tuesday, February 23. There will be an important paper by Mr. Henry G. Granger on The Construction of a Sea Level Panama Canal. The Conservation of Natural Resources is to be discussed and the subject of Professional Education, in connection with an inspection of the Hammond Laboratories of the Sheffield Scientific School. The secretary, Mr. R. W. Raymond, will attempt to arrange hotel accommodations for members of the Society who attend.

OTHER SOCIETIES

THE AMERICAN SOCIETY OF CIVIL ENGINEERS

The American Society of Civil Engineers at their Annual Meeting, January 20, 1909, will take up the discussion of the metric system. The report of a special committee of that Society, which will be presented, strongly favors the general adoption of the metric system, not merely for scientists and engineers.

THE AMERICAN SOCIETY OF REFRIGERATING ENGINEERS

The American Society of Refrigerating Engineers held their fourth annual meeting November 30 and December 1 at the Engineering Societies Building, New York. The following officers were elected: President, Louis Block, New York; Vice-President, Homer McDaniel, Cleveland, O.; Treasurer, Walter C. Reid, New York; Directors, Madison Cooper, New York; N. H. Hiller, Carbondale, Pa.; W. H. Manus, Waynesboro, Pa.

A paper on "The Relative Bacteriological Contents of Can, Plate and Natural Ice under Various Conditions "was presented by Mr. J. C. Sparks; Mr. C. C. Palmer contributed a paper on "Ethyl Chlorid Refrigeration;" "The Construction and Actual Results Obtained from an Ice Making Plant of Moderate Size" was the title of a paper presented by Mr. Charles Dickerman.

One session was devoted to waterproofing and concrete tanks. Mr. W. M. Torrance presented "Reinforced-Concrete Freezing Tanks" and "Waterproofing in Refrigerating Work" was contributed by Mr. Edward W. De Knight. Other papers were: "Standard Method of Testing Refrigerating Machines" by Prof. D. S. Jacobus; "Performance of Ammonia Compression Machines" by Prof. C. E. Lucke; "Does Ammonia Disintegrate in Absorption Plants?" by Mr. Herman Dannenbaum; "Refrigeration Applied to Air Supply for Blast Furnaces" by Mr. Bruce Walter; "Investigations in the Handling of Perishable Products" by Mr. H. G. Powell.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

The Annual Meeting of the Society of Naval Architects and Marine Engineers was held in the Engineering Societies Building, New York, November 19 and 20.

The following Vice-Presidents were elected: Mr. F. L. Fernald, Naval Constructor, U. S. N., Eliot, Me.; Mr. Stevenson Taylor, Quintard Iron Works, New York; Mr. W. M. McFarland, Westinghouse Electric and Manufacturing Co., Pittsburg. Ten members of the Council of the Society were also elected. The terms of office of the other officers had not expired.

Mr. Charles H. Cramp presented a paper upon the "War Eagle," the name of a famous fast sailing vessel of the "Baltimore clipper" type. "The Oldest Iron Ship in the World" was the title of a paper contributed by Mr. Henry Penton of Cleveland, O. A paper on "The British International Trophy Race of 1908" was presented by Mr. W. P. Stevens of Bayonne, N. J. Other papers were: "Shipbuilding on the Great Lakes" by Mr. Robert Curr, Naval Architect of Cleveland, O.; "The Steamer 'Commonwealth' " by Mr. W. T. Berry, and Mr. J. H. Gardner; "Centrifugal Fire Boats" by Mr. C. C. West; "Sea-Going Suction Dredges" by Mr. T. M. Cornbrooks; "Recent Inventions Applied to Modern Steamships" by Mr. W. C. Wallace.

In addition to these historical and descriptive papers, the following papers on design were contributed:

"The Influence of Midship-Section Shape Upon the Resistance of Ships" by Mr. D. W. Taylor; "Experiments on Longitudinal Distribution of Displacement and its Effect on Resistance" by Prof. H. C. Sadler; "Further Analysis of Propeller Experiments" by Mr. C. H. Crane; "The Influence of Free Water Ballast Upon Ships and Floating Docks" by Mr. T. G. Roberts.

There were also papers on trials and operations as follows: "Practical Methods of Conducting Trials of Vessels" by Col. E. A. Stevens; "Service Test of the Steamship 'Harvard'" by Prof. C. H. Peabody, Prof. W. S. Lelande, and Mr. H. A. Everett; "Trials of the U. S. Scout Cruiser 'Chester' " by Mr. C. P. Wetherbee: "Some Remarks on the Steam Turbine" by Mr. J. W. Powell; "The Transportation of Submarines" by Mr. W. J. Baxter; "Deviation of the Compass aboard Steel Ships—its Avoidance and Correction" by Lieut.-Commander L. H. Chandler, U. S. N.

The social event of this convention was the banquet held at Delmonico's, on the evening of the second day.

ANNUAL MEETING OF THE SOCIETY OF AUTOMOBILE ENGINEERS

Members of The American Society of Mechanical Engineers are invited to attend the sessions of the fourth annual meeting of the Society of Automobile Engineers which opens on Tuesday, January 5, at the building of the Automobile Club of America, 54th Street, New York. The morning of the first day will be devoted to tests of different cars on the club dynamometer under the supervision of Henry Souther. Several papers upon subjects related to the design of automobile mechanism are announced. The technical sessions will be held in The Engineering Societies Building on 39th Street.

MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

On the evening of December 11, the Electrical Engineers held a largely attended meeting in the Engineering Societies Building. W. S. Murray, Electrical Engineer of the New York, New Haven and Hartford Railroad Company, presented a paper upon The Log of the New Haven Electrification.

The paper drew out a discussion that was prolonged until after midnight. As usual at Institute meetings, where the subject has to do with the electrification of trunk line railways, the discussors were sharply divided into direct current and alternating current groups. In the resulting contention there was a tendency to overlook the broad engineering features of the paper and for some time the discussion narrowed down to a comparison of the operating conditions on the New York Central and Hudson River Railroad and those on the New Haven Railroad. This was marked in the discussion of the types of locomotives used on the two roads,—the greater draw bar pull per pound of motor weight afforded by the direct current motor *versus* the continuous capacity rating of the single-phase alternating current motor. Later in the evening, however, the drift of the discussion changed and several prominent engineers brought up the broad question of the lowest cost, including fixed charges, between the coal pile and the fare.

BANQUET OF THE ENGINEERS' CLUB

The second Annual Banquet of the Engineers' Club of New York was held at the club house on Saturday evening, December 12. Andrew Carnegie was the guest of honor and other speakers were P. T. Dodge, President of the Club, John Hays Hammond, Presi-

dent of the American Institute of Mining Engineers, Prof. Brander Matthews, Columbia University, and Col. George Harvey, President, Harper and Brothers.

Mr. Carnegie took the opportunity to urge members of the engineering profession to take an active part in the movement for the conservation of our natural resources. He stated that there was no more patriotic duty which the engineers as a body could perform. Mr. Carnegie closed with the statement of his satisfaction in the development of the use of the building of the Engineering Societies and the accompaniment of the social side in the Engineers' Club. The two go hand in hand.

Dr. Hammond spoke with reference to the engineer in politics and predicted that the engineer would more and more take his place in the affairs of the nation by virtue of his training, his directness of method and his rugged honesty; to the same degree which our lamented John Hay had emphasized the success of honesty in diplomacy so the engineer would make a success in politics.

Professor Matthews spoke interestingly on the subject of Simplified Spelling, and President Harvey gave a scholarly address on the relation of the engineer to politics and an encouragement to him to participate in all public affairs.

The souvenir of the occasion was a beautifully designed menu by Tiffany giving photogravures of Mr. Carnegie and of familiar scenes in the rooms of the Engineers' Club. Considerably over 200 were present, among them being the President, Secretary and other members of the Society.

NECROLOGY

DEATH OF R. H. SOULE

It is with great regret that we announce the death of Mr. Richard H. Soule, a charter member of the Society. A full and complete memorial notice will be published in the February issue.

ARVY ELROY WELLBAUM

Mr. Arvy Elroy Wellbaum was born February 12, 1881, at Brookville, Ohio, where he attended the high school. He studied at the Ohio Northern University, Ada, Ohio, for one year, and received the degree of M.E. in 1902 from Ohio State University. During the summer vacations he was in the employ of the C. & G. Cooper Co., Mt. Vernon, O., and Platt Iron Works Co., Dayton, Ohio.

In 1902 he became draftsman for the Morgan Engineering Co., Alliance, O. He became connected with the Foos Manufacturing Co., Springfield, O., in 1903, as designing draftsman, and in 1905 he accepted a similar position with the Foos Gas Engine Co., Springfield, O. For three years he was instructor of mechanical drawing and machine design in the Young Men's Christian Association of Springfield, O. Up to the time of his death, August 31, 1908, he was associated with The Hydraulic Press Co., Mt. Gilead, Ohio, having had charge of the engineering department.

ELMER G. EBERHARDT

Elmer G. Eberhardt of Newark, N. J., an Associate Member of the Society, died at his home on November 21, 1908. He was born in Newark, April 26, 1881, and was graduated from the Newark High School in 1896 He received his technical education in Stevens Institute and Cornell University, receiving the degree of M.E. at the latter institution in 1904.

He learned the machine trade with his father, Henry E. Eberhardt, of the firm of Gould and Eberhardt, at Newark, and upon graduation from Cornell University, he formed, with his father and brothers, the firm of Eberhardt Brothers Machine Co., now the Newark Gear Cutting Machine Co. Mr. Eberhardt was Vice-president of the company, and

was engaged in the design of automatic gear-cutting machines, in which field he invented a number of improvements as well as investigated along original lines. He was a frequent contributor to the technical columns of the mechanical papers. He designed the power plant and equipment of the factory with which he was connected.

Mr. Eberhardt was elected president of the Cornell Society of Electrical Engineers and Vice-president of the Cornell Mechanical Society, as well as receiving the honorary key of Sigma Xi for high scholarship in the scientific branches. He was an Associate Member of the American Institute of Electrical Engineers, and a member of the University Club of Newark and the Cornell Association of Northern New Jersey.

At the time immediately preceding his death, Mr. Eberhardt was engaged, aside from his business connections, in consulting engineering work, in matters relative to gears and gear cutting.

EDWARD L. JENNINGS

Edward Lobdell Jennings, whose death occurred on November 6, 1908, was born in North Wayne, Me., April 14, 1850. He received his education in the public schools of his native town and at the Maine Wesleyan Academy. He was apprenticed to the North Wayne Tool Company, and in 1872 he went to Boston and entered the employ of W. A. Wood & Co. and was their manager for several years. He resigned his position with this company and removed to Waterbury to take the position of purchasing agent for the American Brass Co., held for the eight years preceding his death.

Mr. Jennings was a member of the Waterbury Club, a Commandery Mason and a member of the First Church (Congregational), Waterbury, Conn.

EDWIN H. JONES

Edwin Horn Jones was born in Wilkes-Barre, Pa., April 15, 1844, and died December 2, 1908. He was educated at the Old Dow Academy on South Franklin Street, and at an early age he entered the employ of his father, Richard Jones, who then conducted the Jones Foundry, the foundation of the present extensive Vulcan Iron Works. He learned the iron business thoroughly, advanced to Superintendent of the works, and at the time of his father's death in 1873 he became general manager of the company and later its president, a position he held until the time of his death.

As President of the Vulcan Iron Works he consolidated the Wyoming Valley Manufacturing Co. and the Pittston Iron Works with the

original plant and later purchased the Tamaqua shops, all of which he consolidated as the Vulcan Iron Works.

Nearly twelve years ago he was made President and General Manager of the Sheldon Axle Works. In 1881 he became Director of the Second National Bank, and later its Vice-President. He was interested as stockholder and director in a number of other industries and was an active member of the Wilkes-Barre Board of Trade and one of its trustees. He was a member of the Westmoreland Club and the Wyoming Valley Country Club, the Arts Club of Philadelphia, and the Sons of the Revolution. He was a member of the Central M. E. Church.

PERSONALS

Mr. W. L. Bronaugh has just organized the Iroquois Engineering Co., which will represent the Fitzgibbons Boiler Co., with offices at 1211 Fisher Bldg., Chicago, Ill., Mr. Bronaugh has recently been in the employ of the B. F. Sturtevant Co., as manager of the Chicago house.

Mr. George A. Orrok, Mechanical Engineer of the New York Edison Co., delivered a lecture on Central Station Design at a meeting of the Modern Science Club, Brooklyn, Tuesday evening, October 27.

Mr. H. de B. Parsons was appointed by the Governor a delegate from the State of New York to the conference of the Atlantic Deep Waterways Association, held in Baltimore, Md., on November 17–18, 1908.

Mr. James A. Pratt, who for the past two years has held a position as Instructor in Machine Work at Pratt Institute, Brooklyn, N. Y., has been appointed to a similar position at Williamson Free School of Trades, Delaware County, Pa.

Mr. Ellis Soper has resigned the positions of Vice-Presidents of the Hunt Engineering Co., Iola, Kansas, and Superintendent of the Dixie Portland Cement Co., S. Pittsburg, Tenn., to become President of The Soper Company with headquarters at 1110–11 Ford Building, Detroit, Mich. This company has been organized for the purpose of dealing in all standard cement machinery and doing general cement engineering work.

Messrs. Fred H. Colvin and Frank A. Stanley, Associate Editors of the American Machinist, are co-authors of the American Machinists' Handbook and Dictionary of Shop Terms.

Mr. Edmund Kent has resigned his position with the Boston and Montana Consolidated Copper and Silver Mining Co., Butte, Montana.

Professor William Kent, who has until recently been Dean of the L. C. Smith College of Applied Science, Syracuse University, Syracuse, N. Y., is to become General Manager of the Sandusky Foundry and Machine Co., Sandusky, O.

Mr. Oscar E. Perrigo is President of the Modern Systems Correspondence School Co., which has recently been organized with offices at 6 Beacon St., Boston, Mass., and 132 Nassau St., New York. The purpose of the Company will be to conduct a Correspondence School of instruction in Modern Cost Systems, Factory and Commercial Office Systems, Shop Methods and Systems, etc. Mr. Norman W. Henley is Secretary and Treasurer of this organization.

THE JOURNAL

OF

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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POSTPONEMENT OF THE FEBRUARY MEETING

THE February meeting will be held on Tuesday, February 23. The subject of Safety Valves will be opened up by Mr. F. M. Whyte, member of the Council. Important contributions to this subject will be made by prominent manufacturers.

THE SPRING MEETING

The spring meeting will be held in Washington, D. C., early in May. At the time of the meeting held there ten years ago, it was urged that it would be desirable to hold conventions of the Society in Washington at stated intervals. This suggestion met with general approval, as being an advantage to the profession as well as emphasizing the national character of the organization.

The many places of interest in Washington will be an added incentive to attendance, and those who were at the previous convention will recall the courtesy offered them in their visits to the White House, the Navy Yard, the Washington Monument, the Library of Congress, the Patent Office; and the trip to Mt. Vernon, where appropriate ceremonies were held at the tomb of Washington, and a tree planted in the name of the Society among the memorial trees along the driveway of the Mt. Vernon estate.

A convention held in Washington promises a great deal besides the interest of the professional sessions.

THE FORMATION OF SECTIONS

The formation of sections is becoming a very welcome activity of the Society, and is one of the steps toward expansion which the Council and membership are pleased to see.

The Gas Power Section, which was the first section formed, successfully met a need for organized coöperation to encourage the exchange of information and experience, so necessary in that particular industry. This branch of engineering was growing so rapidly, and so much needed to be said and written, that it was obvious that a section should be devoted to it. It could then hold meetings, and give as much time to discussion as seemed desirable. The benefit derived and the continued interest has been very great. The Society would be pleased to see further steps along the same lines.

Another welcome movement is for student affiliate sections, which may be formed at schools of engineering. Stevens Institute of Technology leads with the first section. An account of their work will be found elsewhere in these columns. Cornell has been granted permission to form a section and two other universities have applied.

The student societies may have complete independence and self-control under their own by-laws, subject only to such limitations as may be set by the Council. They must have as Honorary President a member of this Society, and preferably the Professor of Mechanical Engineering in the institution in which the section exists. With such a guiding hand, the activities of the affiliates may be developed in harmony with the policy and traditions of the Society.

Upon payment of $2 per year, students may become affiliates, receive "The Journal," and attend all meetings.

STEVENS INSTITUTE ENGINEERING SOCIETY, AFFILIATED WITH THE A. S. M. E.

The Stevens Institute Engineering Society formed the first student branch affiliated with the Society under the rules for such sections recently enacted by the Council.

The Honorary President, who by requirement must be a member of the A. S. M. E., is Dr. Alex. C. Humphreys, President of Stevens Institute of Technology. The President of the Section is Mr. E. Nyland, of the senior class. A list of the 29 affiliates will be found under "Changes in Membership" in this issue.

A meeting of the Section has been held, which was addressed by Professor Ganz, head of the department of Electrical Engineering at

Stevens, on the subject of Electrolysis. The Branch has also made an inspection trip to the Western Electric Company's West Street works, New York.

The Stevens Society, believing that the interest of the members can be held only by thought and work on the part of the members, has opened a competition for the best write-up of an inspection trip, or of a general or special lecture. It is also the aim to encourage questions at the close of the lectures, to clear up points not entirely understood, and open avenues for discussion.

The policy of the Branch is to open their lectures to all students; but special lectures and inspection trips may be participated in only by members.

We feel that the Stevens Branch has taken an energetic step in the right direction in their inspection trips, the competition reports, and especially in their policy of holding the interest of the members by insisting upon work from them. The importance of discussion and coöperation should be learned early and emphasized. The value of conducting meetings; of coming together with a common interest for discussion; of having an organization which provides for visits and inspection trips, invites lectures and at the close of the college course places its members in direct line for membership in the national organization of their profession, ought to make an appeal to progressive, ambitious young engineering students.

JANUARY MEETING

The monthly meeting was held in the Engineering Society's Building on the evening of the twelfth, at which the paper on "The Transmission of Power by Leather Belting" was given by Carl G. Barth. The meeting was largely attended, and of unusual interest. The author used the lantern to assist him in his explanations of the diagrams in the published paper, and these views were supplemented by others showing the practical application of belting under different conditions.

Many engineers participated in the discussion, which was varied in character, and appreciative of the magnitude and usefulness of the work accomplished by the author in the development of his theory of belting, and which so effectually supplements the results of earlier investigators. The paper was discussed technically, and also by those familiar with the installations made by the author, where greatly improved performance of belting has been secured.

Following the discussion which pertained strictly to the subject matter of the paper, was a general discussion upon the transmission of power by electricity and by rope, and by the modern types of chains used for power transmission. Written discussions were submitted by A. F. Nagle, Prof. Wm. W. Bird, Prof. C. H. Benjamin, H. K. Hathaway, and Prof. L. P. Breckenridge. Oral discussions were given by Henry R. Towne, Wilfred Lewis, W. D. Hammerstadt, Fred W. Taylor, Charles Robbins, Geo. N. Van Derhoef, Walter L. Allen, Dwight V. Merrick, Fred A. Waldron, S. B. Flint, and A. A. Carey.

APPOINTMENT OF MR. FREEMAN

Mr. John R. Freeman, Past President of the Society, has been appointed by President Roosevelt a member of the Board of Engineers, to accompany President Taft on his visit to the Panama Canal.

THE NEW OFFICERS OF THE SOCIETY

Vice-Presidents

GEORGE M. BOND

Mr. George M. Bond graduated from Stevens Institute of Technology, in 1880, receiving the degree of Mechanical Engineer. Several months previous to his graduation he was associated with Prof. Wm. A. Rogers, professor of astronomy at Harvard College Observatory, Cambridge, in the work of establishing, on a scientific basis, standards for linear measurement. This work was carried out and practically applied through the liberal spirit of The Pratt and Whitney Co., of Hartford, Conn., the keen appreciation of the value of such an investigation being a distinctive characteristic of the late Francis A. Pratt, then president of the company, and a charter member of this Society. Mr. Bond was engaged in this work and its subsequent development with the above company from 1880 until 1902, as manager of the standards and gage department. Since then he has been engaged in special work in relation to standards and their practical application.

Mr. Bond is a member of the American Society of Civil Engineers, the Engineers' Club, and the Transportation Club, and is a Fellow of the American Association for the Advancement of Science. He was President of the Alumni Association, Stevens Institute of Technology, 1886–1887, and Alumni Trustee, 1895–1898.

Mr. Bond served as Manager of the Society from 1888–1891 and has presented the following papers: Standard Measurements, A Standard Gage System, Standard Pipe and Pipe Threads.

He has done important work on the Committee on Standards for Pipe Unions, Standard Gages for Thickness, and Standard Proportions for Machine Screws.

R. C. CARPENTER

Dr. Rolla Clinton Carpenter was born in Michigan, June 26, 1852. He received his early education in the schools and colleges of that state, and was graduated from the University of Michigan with the class of 1875, as a civil engineer. He spent one year in actual rail-

road construction, and afterward accepted a position as Professor of Mathematics and Engineering in the Michigan Agricultural College, in which position he remained until 1890, when he accepted the professorship in Experimental Engineering at Cornell. He received the degree of C.E. from his alma mater; M.S. from Michigan Agricultural College, and M.M.E. and LL.D. from Cornell.

While at Lansing, Doctor Carpenter was consulting engineer for the Lansing Engine and Iron Works, in which capacity he designed the governor for their automatic engine. At this time, he made a large number of tests to determine the friction of various engines under different conditions. He has been engineer for several important constructions and installations in the state of Michigan; engineer for electric railroad companies; has made plant and engine tests, and has designed heating and ventilating systems for public buildings. He is also the designer of a number of the smaller pieces of apparatus used in steam and experimental engineering; among these are a coal calorimeter, a steam calorimeter, and a steam separator.

Doctor Carpenter is the author of text books on Experimental Engineering, and on Heating and Ventilating. In connection with Prof. H. Diederichs he has published a book on Internal Combustion Engines. Besides these larger works, he has written many articles of scientific and engineering interest for this Society and for various engineering periodicals.

Doctor Carpenter was a judge at the World's Columbian Exposition in the Department of Machinery, acting in addition on a special committee from the Department of Transportation, to award diplomas to exhibitors of car heating devices. He was a judge of power and machinery exhibits at the Pan-American Exposition and at the Jamestown Exposition. He is a member of the American Institute of Mining Engineers, American Society of Refrigerating Engineers, Past President of Heating and Ventilating Engineers, and Automobile Engineers. He is a member of the college fraternity of Delta Tau Delta, of the honorary society of Sigma Psi and of several clubs among which may be mentioned the Town and Gown and Craftsman Club, Ithaca, N. Y., the Engineers' Club, New York.

F. M. WHYTE

Mr. F. M. Whyte graduated with the degree of Mechanical Engineer, Cornell University, 1889. Since that time he has been interested in the rolling-equipment branch of railroad work, being connected

at various times with the B. &. O., the Chicago & Northwestern and the elevated roads in Chicago. He is now General Mechanical Engineer of the New York Central Lines. Mr. Whyte has been Secretary of the Western Railway Club and also of the New York Railroad Club. He has written several papers for the technical press.

MANAGERS

H. L. GANTT

Mr. H. L. Gantt was born in Maryland, May 20, 1861. He received his early training at the McDonogh School near Baltimore. In 1880 he received the degree of A.B. from Johns Hopkins University, and the degree of M.E. was conferred upon him by the Stevens Institute of Technology in 1884.

For two years he was in the employ of the Midvale Steel Company. He was with the American Steel Casting Co., one year, as superintendent of their Thurlow, and later their Norristown plant. For two years he was associated with the Simonds Rolling Machine Co., acting as superintendent most of the time. He accepted a position with the Bethlehem Steel Co., helping Mr. F. W. Taylor to install his system of management. He was with this company two and a half years, after which he acted as consultingengineer for the American Locomotive Co., and subsequently for a number of plants. He is a member of the Society of Naval Architects and Marine Engineers.

He has written the following papers for this Society: A Bonus System of Rewarding Labor; A Graphical Daily Balance in Manufacture; Training Workmen in Habits of Industry and Coöperation. He has written for the Engineering Magazine, The Coöperation of Labor, and presented Scientific Methods and the Labor Problem before the International Congress of Arts and Sciences, St. Louis, September 23, 1904.

I. E. MOULTROP

Mr. Irving E. Moultrop was born in Marlboro,Mass., July 1865, and received his education at the public schools in Framingham, Mass. After graduating from the high school at the age of eighteen he entered the employ of the Whittier Machine Co., Boston, Mass., as apprentice. During the three years of apprenticeship he prepared himself for a draftsman, by studying in evening schools and doing other work during his spare time.

On the expiration of his apprenticeship, he entered the drawing-room of the same company, and at the end of two years was advanced to the position of head-draftsman. He held this position until January 1892, when he accepted a position with the Edison Electric Illuminating Co., of Boston, in charge of their drawing-room. Mr. Moultrop is at present mechanical engineer for the company, having charge of all construction work except the transmission work and electrical work done outside of the stations. During a part of this time he was in charge of the company's repair shops. Three years ago, he was sent abroad by the company to investigate the steam turbine situation in England and on the continent.

Mr. Moultrop is a member of the Boston Society of Civil Engineers, the National Electric Light Association, and the New England Street Railway Club. He has served on the Steam Turbine and the Gas Engine Committees of the National Electric Light Association.

Mr. Moultrop is joint author, with Mr. R. E. Curtis, of Recent Construction at the Atlantic Avenue Station of the Edison Electric Illuminating Co., of Boston, which was presented at the Spring meeting of this Society, held in Boston, Mass., in 1902.

WILL J. SANDO

Will J. Sando was born April 9, 1864. His practical experience began with a five-years apprenticeship to the machinists' trade after which he spent two years as mechanical draftsman with the Dickson Mfg. Company, of Scranton, Pa., and was then engaged as draftsman and inspector of all kinds of machinery for the Calumet & Hecla Mining Company. Mr. Sando has also acted as draftsman-in-charge of the drawing office in connection with the U. S. Government engineers at the Wm. Cramp & Sons Shipyards, Philadelphia, Pa.; inspector of machinery, and later superintendent of pumping stations of the Metropolitan Water Board, Commonwealth of Massachusetts; chief engineer and manager of the pumping engine department of the International Steam Pump Company, New York; engineer of the pumping department of the Burr-Herring-Freeman Commission on additional water supply for the City of New York; and, since September 1, 1904, as manager of the pumping engine and hydraulic turbine department of the Allis-Chalmers Company, Milwaukeee, Wis.

Mr. Sando is a member of the Boston Society of Civil Engineers, New England Water Works Association, American Water Works

Association, American Society for the Advancement of Science, American Academy of Political and Social Science, Engineers' Club, New York, Machinery Club, New York, Country Club, Pittsburgh; Milwaukee Club and Country Club, Milwaukee.

MEETING OF THE COUNCIL

There were present at the January meeting of the Council, Tuesday, January 12, 1909, Messrs. Bond, Basford, Hutton, Gantt, Miller, Moultrop, Smith, Waitt, Whyte and the Secretary. Mr. Jesse M. Smith, President, occupied the chair.

The minutes of the previous meeting were read and approved.

The President reported the appointment of members to the vacancies on the Standing Committees, and a meeting of all the committees on Tuesday, January 5, when they organized.

Hudson-Fulton Commission. The President reported the receipt of an invitation from the Committee on Historical Exhibits of the Hudson-Fulton Commission, to meet with the Presidents of the other national engineering societies to consider the desirability of holding a loan exhibition showing our development in steam navigation.

It was voted that the President accept the invitation and that our participation in the matter be referred to the Executive Committee for consideration and report.

Deaths. The following deaths were reported: E. L. Jennings, W. E. Hill, E. H. Jones and A. R. Wolff, Charter Member.

Involute Gearing. It was voted that the President appoint a committee of five members to formulate standards for Involute Gears and present them to the Council.

It was voted that the Secretary make an effort to collect from members of the Society who are in arrears for purchases and dues; upon failure to collect to secure the return of the purchases; if that is not possible to institute replevin suits. Recommendation was made that such members be dropped from the rolls of the Society.

International Standard for Pipe Threads. It was voted that the final report of the Committee on International Standard for Pipe Threads be received and placed on file and a copy transmitted to the honorary Vice-President of the Society representing the Society at the Paris Congress and that the same be published in the Transactions.

OTHER SOCIETIES

MEETINGS A. I. M. E.

A meeting of the American Institute of Mining Engineers will be held at New Haven, Conn., on Tuesday, February 23. Sessions held in North Sheffield Hall of Yale University.

The following subjects will be discussed: The Conservation of Natural Resources; A Sea Level Canal in Panama; The Technical Education of Mining Engineers, etc.

About thirty papers, including the above and miscellaneous subjects, will be read. The Hammond Laboratory of the Yale University, the works of the National Pipe-Bending Company, the plant of the New Haven Gas Company, the Bigelow Boiler Works, the Farrel Foundry and Machine Works, the brass and copper rolling mills of the Coe Brass Company, the Locomobile works, the American Tube and Stamp Works and the works of the Crane Company, valve manufacturers, will be visited.

The governing board of the Sheffield Scientific School will give a reception to the members and guests at Byers Memorial Hall.

Dr. R. W. Raymond, Secretary of the Institute, will deliver a lecture on the Influence of Geology upon the History of Jamaica. Visits will also be made to the Cos-Cob Plant of the N. Y., N. H. &. H. R. R. Co.

All members of this Society are cordially invited to attend the above sessions, and any intending to accept are invited to correspond with Dr. Raymond in order to secure the necessary hotel accommodations.

Election of Officers. The annual business meeting of the Institute will be held at No. 29 West 39th Street, New York, on February 16 at 11 o'clock. At this meeting three directors of the corporation, and officers and members of the council, will be elected.

MEETINGS A. I. E. E.

The American Institute of Electrical Engineers held a meeting on January 8, 1909. The Secretary announced that 114 Associates had been elected, and five Associates transferred to the grade of Member. Professor Elihu Thomson, electrician of the General Electric Com-

pany, read a paper entitled, Conditions Affecting Stability in Electric Lighting Circuits. The paper was discussed by Messrs. A. E. Kennelly, Alex Dow, E. W. Rice, Jr., Dugald C. Jackson, C. M. Green, John B. Taylor, C. P. Steinmetz, and Elihu Thomson.

The American Institute of Electrical Engineers will hold their February Meeting in the auditorium of the Engineering Societies Building, February 19, 1909, at 8 p.m. Dr. Charles P. Steinmetz, consulting engineer of the General Electric Company, Schenectady, N. Y., will present a paper entitled Prime Movers.

MEETINGS TO BE HELD IN THE ENGINEERING SOCIETIES BUILDING

The following meetings will be held in the Engineering Societies Building during February and March.

Date		Society	Secretary	Time
Feb.	2	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	4	Blue Room Engineering Society	W. D. Sprague	8:00
"	5	Explorers Club	H. C. Walsh	8:30
"	9	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	11	Illuminating Engineering Soc.	P. S. Millar	8:00
"	12	American Inst. of Electrical Engrs	R. W. Pope	8:00
"	16	N. Y. Soc. of Accountents & Bkprs	T. L. Woolhouse	8:00
"	16	N. Y. Telephone Society	T. H. Laurence	8:00
"	17	N. Y. Electrical Society	G. H. Guy	8:00
"	19	N. Y. Railroad Club	H. D. Vought	8:15
"	23	American Geographical Society	A. A. Raven	8:00
"	23	N. Y. Society Accountants & Bkprs	T. L. Woolhouse	8:00
"	23	American Soc. of Mech. Engrs	Calvin W. Rice	8:15
"	24	Municipal Engrs. of N. Y	C. D. Pollock	8:15
Mar.	2	N. Y. Society Accountants & Bkprs	T. L. Woolhouse	8:00
"	4	Blue Room Engineering Society	W. D. Sprague	8:00
"	5	Explorers Club	H. C. Walsh	8:30
"	9	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	9	American Soc. of Mech. Engrs	Calvin W. Rice	8:15
"	11	Illuminating Engineering Society	P. S. Millar	8:00
"	12	American Inst. of Electrical Engrs	R. W. Pope	8:00
"	16	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	16	N. Y. Telephone Society	T. H. Laurence	8:00
"	19	N. Y. Railroad Club	H. D. Vought	8:15
"	23	American Geographical Society	A. A. Raven	8:00
"	23	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	24	Municipal Engineers of N. Y	C. D. Pollock	8:15

GENERAL NOTES

INTERNATIONAL CONSERVATION CONGRESS

The following in regard to the International Conservation Congress, which President Roosevelt has called to meet in Washington, February 18, is taken from the January 9 issue of the Outlook:

President Roosevelt requested Earl Grey, Governor-General of Canada, and President Diaz of Mexico to send representatives to attend a conference on conservation of our natural resources of North America to be held at Washington, February 18, 1909. The proposed conference grows out of the two conservation conferences already held at Washington. At the first of these, last May, governors of states and territories were the principal conferees with the President. At the second, a month ago, the conferences were increased by the national conservation commission members appointed last summer.

Even before the first conference was called many observers felt that the movement should be international in character. It was, however, deemed advisable not to enlarge its national character at that time. Last spring, Mr. Bryce, British Ambassador at Washington, remarked at the Canadian Club dinner in New York City that the utmost gratitude was due to President Roosevelt for calling attention to the magnitude and gravity of the problem of natural resource conservation, declaring that the question interested Canadians almost as much as it did our own people, and that in any event Canadians ought to be stirred up to preserve their own forests. Mr. Bryce was illustrating the way in which the example of each country might be helpful to the other, but he could have added that we of this side of the border might well imitate certain Canadian methods of forest preservation long in successful operation.

At the tariff hearings at Washington and the subsequent discussions, a great deal was said about Canadian lumber.

Some observed that Canadian forests are rich both in quantity and quality, others maintained the contrary. Some said that if we make lumber free, we may draw more fully upon Canadian forests and then spare our own. Others said that just the contrary would be the case, that the introduction of cheap Canadian lumber would cause an increased cutting of our hard woods.

To conserve resources in their entirety we must naturally know not only about our own but about those across the two borders.

The plans of the Reclamation Service have been increased to cover an acreage of about two million three hundred thousand acres, at an estimated cost of about ninety million dollars. All official communications or reports from and to executive officers of the territories and territorial possessions of the United States are

now transmitted through the Secretary of the Interior. This centralizing of information has proved of great benefit.

The meeting of the governors with the President last May has been held by many to be the greatest single event of the Roosevelt administration. It now receives its logical development in the meeting planned for next month in which questions of national economics will be expanded to include those involving international coöperation. The citizens of three nations will realize that after all, their industries and interests are practically the same; that hitherto destructive rather than preservative tendencies in dealing with natural resources have been shown and especially that the force is only genuinely preservative if it includes the legitimate use of all resources and thereby creates enduring profit, replacing the temporary profits, which in some cases must cease with the extinction of the resources.

SPECIAL MESSAGE FROM THE PRESIDENT ON CONSERVATION

President Roosevelt sent a special message to Congress on January 22, concerning the report of the national conservation commission. He urged action by congress for the preservation and development of the resources of the country, and characterized the report as being "One of the most fundamentally important documents ever laid before the American people." He called attention to the fact that it contains the first inventory of natural resources ever made by any nation, and urges that the facts set forth in this report are an imperative call to action; the conditions they disclose demand that we shall concentrate an effective part of our attention upon the great natural foundations of national existence, progress and prosperity. He said:

The inventory is an irrefutable proof that the conservation of our resources is a fundamental question before this nation, and that our first and greatest task is to begin to live within our means.

The first of all considerations is the permanent welfare of our people; and true moral welfare, the highest form of welfare, cannot permanently exist save on a firm and lasting foundation of material well-being. In this respect our situation is far from satisfactory. After every possible allowance has been made, and when every hopeful indication has been given its full weight, the facts still give reason for grave concern.

It would be unworthy of our history and our intelligence and disastrous to our future to shut our eyes to these facts or attempt to laugh them out of court. The people should and will rightly demand that the great fundamental questions shall be given attention by their representatives. I do not advise hasty or ill-considered action on disputed points, but I do urge, where the facts are known, where the public interest is clear, that neither indifference and inertia, nor adverse private interests, shall be allowed to stand in the way of the public good."

The President recommended that the plan for the development of water ways recommended by the Inland Water Ways Commis-

sion be put in effect without delay, and urged that provision be made for the protection and more rapid development of the National forests.

NEW YORK STATE WATER WAYS ASSOCIATION

The New York State Water Ways Association held a two-days conference in Brooklyn on January 21 and 22. The conference closed with the resolution asking Congress to establish a national department of public works with a secretary who should be a member of the President's Cabinet.

Another resolution urged the officials of the city of New York to be doubly sensitive to anything that might tend to injure the manufacturing interests. The city was also asked never to permit the discontinuance of ferry traffic between the two boroughs.

Norman B. Fish, of Tonowanda, speaking of the Erie Canal, said that Canada had spent $150,000,000 on a water transportation system to divert traffic which should pass through New York.

Congressman Joseph E. Randall said that the appropriations by Congress for deep waterways was altogether too meager.

SOUTH DAKOTA

The conservation commission of South Dakota, in a preliminary report recommended the following measures for the conservation of the soil, water resources, forests and coal.

(1) Conservation of the soil.

Make the wilful waste of the fertility of the soil a public offense with heavy penalties.

Provide for the education of the people upon the most approved methods of agriculture, having in view the preservation of the fertility of the soil, in the public schools, in farmers' institutes and through the public press.

Encourage the application of dry farming methods in agriculture, through the experimental stations and in the farmers' institutes.

(2) Conservation of the water resources.

By strict regulation of the boring, flow and use of the artesian waters.

By impounding the flood waters in draws and valleys.

(3) Preservation of our natural forests and encouragement of forestry.

Our natural forests are chiefly within the natural forest reserves, and are receiving the careful attention of the national government. Such forests as are so protected should be carefully guarded by the laws of the state and especially should there be enforced rigorous penalties for the setting of forest fires. Tree planting should be encouraged by every proper means.

(4) Preservation of the coal mines for the use of the people.

Prompt action should be taken by the state and nation to prevent the coal measures of the state from passing into the hands of private monopolies, and such regulations be adopted as will preserve the great gift of nature for the benefit of the public.

VERMONT

The Legislature of Vermont has passed a bill appointing a forestry commission. The commission will consist of five members, including the Governor of the State and the director of the experiment station. The members of the commission will serve without pay, but a salaried State forester will be appointed. The commission may accept or buy waste land for forestry purposes.

AVIATION

The French Government, through M. Barthou, Minister of Public Works, offers 100,000 francs for the encouragement of aërial locomotion, the government reserving the right to decide how the money shall be spent.

M. Barthou is of the opinion that open spaces should be provided by the government for the use of the aëronauts.

THE PRESENT STATUS OF MILITARY AËRONAUTICS

The War Department has issued the paper on Aëronautics by Maj. George O. Squier, of the U. S. A. Signal Corps, presented at our Annual meeting, 1908, in separate form for the use of officers interested in the subject. It is considered the most up-to-date and comprehensive treatment of the dirigible, the free balloon and the heavier-than-air machine that has been written.

Technical Colleges

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY BANQUET

The Massachusetts Institute of Technology held their annual banquet in Boston, January 14, 1909. Addresses were made by Governor Eben S. Draper, of Massachusetts, a member of the Class of '78; Acting President Arthur A. Noyes, Class of '86; the President-Elect Richard C. Maclaurin and Dr. R. S. Woodward, of the Carnegie Institute of Washington.

Dr. Maclaurin spoke about the desirability of removing the Institute to a place which would allow its development to continue. Governor Draper spoke of the Institute problems, and their solution under the guidance of the coming administration. Dr. Noyes gave a brief account of the recent work of the Institute, and Dr. Woodward emphasized the value of coöperation and mutual support.

Mr. Edwin S. Webster, of the Class of '86, a member of the firm of Stone & Webster, of Boston, was elected President of the Alumni Association for the ensuing year.

UNIVERSITY OF MICHIGAN

The new engineering building of the University of Michigan is to have an addition in the form of a wing, 60 ft. wide, 130 ft. long and four stories high.

Land for a summer camp for the civil engineering students has been presented to the University by Col. and Mrs. Charles C. Bogardus of Pellston, Mich. The tract contains 1500 acres in Cheboygan County, with nearly three miles of shore line upon Douglas Lake.

A new reflecting telescope is to be added to the equipment of the observatory.

THE MECHANICAL ENGINEERING DEPARTMENT OF COLUMBIA

The graduates and former students of the Engineering Department of Columbia University dined together on January 16. All the classes since 1901 were represented among the thirty-five men present.

Dean Goetze was a guest, and spoke briefly upon the merits of the organization, assuring the society of his coöperation and assistance. Professor Lucke also spoke, outlining the possibilities of the society, and emphasizing the importance of an inter-communication bureau of the members.

PERSONAL

Mr. O. G. Bennet, who was until recently connected with the American Trading Co., Kobe, Japan, has severed his connection with that company and will spend several months in traveling.

Mr. James M. Brown, for two years with the Casey & Hedges Co., Chattanooga, Tenn., is at present with the Lyons Boiler Works, De Pere, Wis., in the capacity of Superintendent.

Mr. Harry M. Chamberlain, formerly of Dorchester Center, Mass., has accepted a position with J. W. Buzzell, Civil and Mechanical Engineer, The Tribune Building, New York.

Mr. George William Cole, formerly with Westinghouse-Church-Kerr & Co., has accepted a position as Secretary of The Economic Engineering Co., 50 Church St., New York.

Mr. Claude E. Cox is now located with the Interstate Automobile Co., Muncie, Ind., as Chief Engineer and Factory Manager.

Mr. Edward R. Feicht has entered the service of the American Beet Sugar Co., as Master Mechanic of the Lamar Factory, Lamar, Colo.

Mr. Burton P. Flory, connected with the Central Railroad of New Jersey for several years, has been appointed Superintendent of Motive Power Department of the Ontario and Western Railroad.

Prof. W. F. M. Goss, Dean of the College of Engineering, and Prof. L. P. Breckenridge, Professor of Mechanical Engineering of the University of Illinois, were the guests of honor at an informal luncheon given by a number of graduates of the University, at the Duquesne Club, in December. Both Professors Goss and Breckenridge are acting in an advisory capacity in connection with the United States Geological Survey Testing Plant at Allegheny Arsenal. Professor Breckenridge is Vice-President of the Society.

Mr. Morris A. Hall is no longer connected with Mack Bros. Motor Car Co., Allentown, Pa. He is at present on the staff of The Automobile, 231 W. 39th St., New York.

Mr. Walter L. Hill, recently connected with the Eastern Cold Storage Co., Boston, Mass., as Treasurer, is at present a partner of the firm Hill-Ray Engineering Co., with offices at 110 State St., Boston, Mass.

Mr. David T. Jones, has been transferred to the Pottstown, Pa., office of the Wilbraham-Green Blower Co. He was formerly located at the Philadelphia office of this company, in the same capacity, Treasurer and General Manager.

Mr. Dermot McEvoy has recently been engaged by the Revere Rubber Co., Chelsea, Mass. Mr. McEvoy was formerly associated with the Derby Rubber Co., Derby, Conn., as Vice-President and General Manager.

Mr. Charles H. Repath, formerly with the Anaconda Copper Mining Co., Anaconda, Mont., as Mechanical Superintendent, has entered the employ of the International Smelting and Refrigerating Co., Salt Lake City, Utah, in the capacity of Superintendent of Construction.

Mr. William N. Ryerson, who until recently was Superintendent of The Ontario Power Co. of Niagara Falls, has accepted a position with The Great Northern Power Co., Duluth, Minn., as General Manager.

Mr. John V. Schaefer, who has been associated with the Roberts & Schaefer Co., Chicago, Ill., as President, is now connected with the Schaefer Manufacturing Co., Birmingham, Ala., in the same capacity.

Mr. W. H. Smead, who has lately been connected with the Proximity Manufacturing Co.'s Mills, Greensboro, N. C., has opened an engineering office at 302 McAdoo Building, Greensboro, N. C. He will make a specialty of designing steam power and heating plants.

Mr. Thomas J. Walsh is no longer in the employ of the Woonsocket Electric Machine and Power Co., Woonsocket, R. I. He has accepted a position with the Tampa Electric Co., Tampa, Florida.

Mr. Edward C. Wells, formerly Manager of the Quincy Engine Works, Quincy, Ill., has accepted a position with the Hardie-Tynes Manufacturing Co. as Superintendent.

Mr. Thomas D. West has issued a pamphlet on Accidents, Their Causes and Remedies, setting forth the reasons for the greater percentage of accidents occurring in this country than in any other, and offering suggestions for remedies calculated to prevent them.

NECROLOGY

GEORGE W. CORBIN

George W. Corbin was born in New Britain, Conn., March 3, 1859. He attended the local schools and Wilbraham Academy until 18 years of age. His first business connection was with P. & F. Corbin, who later organized the Corbin Cabinet Lock Company, making Mr. Corbin manager, and later secretary and president. He resigned to become president of the Union Manufacturing Company, and held this position until his death, November 30, 1908. He organized several other manufacturing corporations, and took an active part in municipal affairs—the savings banks, local government and schools.

He was connected with several social orders, among them being the Masonic order, in which he had received the thirty-third degree, and numerous social clubs.

WARREN E. HILL

Warren E. Hill was born in New York in 1835. In 1852 he entered the service of the Allaire Iron Works in Newark, N. J., and was associated with that company for six years. In 1858 he was appointed superintendent in charge of the installation of the Detroit (Mich.) water works, which position he held until 1862, when he returned to the East and accepted a position with the Continental Iron Works of Brooklyn. In 1888 he was made vice-president, and in 1907 president of this firm, the position he held at the time of his death. Mr. Hill was the designer of the machinery and engines of the original "Monitor," which defeated the "Merrimac" in Hampton Roads.

His death occurred in New York, December 8, 1908. He became a member of this Society in 1884.

RICHARD HERMAN SOULE

Richard Herman Soule was born March 4, 1849, in Boston, Mass. September 25, 1875, he entered the service of the Pennsylvania Railroad, where he remained for eight years. He held this position for

two years until promoted to the test department. Two years later, in 1879, he was made superintendent of motive power of the Northern Central Railway.

In 1881 and June 1882, he was superintendent of motive power of the Philadelphia and Erie division of the Pennsylvania Railroad, and in June 1882 accepted a position in the same capacity with the Pittsburg, Cincinnati and St. Louis Railway.

In 1883, when the West Shore Railway enterprise was carried through, its managers secured the best talent available in the country for their managing officers, and Mr. Soule was appointed superintendent of motive power, a position which he held until the absorption of the West Shore Line by the New York Central in 1887. From February 1887, to April 1888, he was general manager of the New York, Lake Erie and Western Railroad, and in November 1888, he was appointed general agent of the Union Switch and Signal Co. He was engaged in the introduction of modern interlocking and lock-signaling plants until 1891. From 1891 to 1897 he was superintendent of motive power of the Norfolk and Western Railroad, and did much to put the rolling-stock of the system, which was then coming into prominence as an important coal-carrying road, on a thoroughly sound basis.

For the next two years, Mr. Soule was in the employ of the Baldwin Locomotive Works, spending nearly a year traveling in foreign countries. He had charge of the Chicago office of this company for a year and a half.

In 1900 he opened an office in New York as a consulting mechanical engineer and practiced until, on account of ill health, he was forced to retire from active business.

Mr. Soule was a member of the Master Car-Builders Association; and author of a report on the standards of this association, which led to a radical change in the association's practice, and to a placing of the standards on a much higher basis. He was also a member of the American Railway Master Mechanics Association. He was one of the managers of this Society, 1898–1901.

He was universally respected and esteemed for his many sterling qualities, which caused his acquaintance to be highly prized by his associates. In all parts of the country men are found who testify to the help given them early in life by Mr. Soule, to whom they owe much of their later success. His memory will live long in the hearts of those to whom he had endeared himself.

Mr. Soule's death occurred at his residence in Brookline, Mass., December 13, 1908.

THOMAS GRAY

Dr. Thomas Gray, Vice-President and Professor of Dynamic and Electrical Engineering of Rose Polytechnic Institute, Terre Haute, Ind., died December 19, 1908.

He was born in Fifeshire, Scotland, February 2, 1850. He took a course in engineering at the University of Glasgow, Scotland, where he graduated in 1878 with the degree of B.S. Later he took a four-year course in practical physics and telegraph engineering under Sir William Thomson (Lord Kelvin).

He was engaged by the Japanese government as instructor in telegraph engineering at the Imperial College of Engineering at Tokio, Japan. After this engagement he was employed by Sir William Thomson and Professor Fleming Jenkin, engineers of the Commercial Cable Co., to superintend the manufacture and the laying of that Company's system of transatlantic and other cables, and had sole charge under them, as resident engineer, of the whole of that work. He was later chief assistant to Lord Kelvin in his engineering work.

In 1888, he was appointed to the professorship at Rose Polytechnic Institute, and held the position until his death.

Doctor Gray was the author of Directions for Seismological Observations, in the British Admiralty Manual of Scientific Inquiry; of articles on telephones and telegraphs in the Encyclopædia Britannica, and of the Smithsonian Physical Tables. He also wrote many papers on scientific and technical subjects, and was engaged as an expert in electricity on the staff of the Century Dictionary.

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OF

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SPRING MEETING

MAY 4–7, WASHINGTON, D. C.

THE chairman of the Meetings Committee, Mr. Willis E. Hall, and the Secretary, attended a meeting, February 17, of members residing in Washington and vicinity who met to organize a local committee and prepare the program for the Spring Meeting. It was voted that all members in Washington and vicinity be considered the local committee. Mr. Walter A. McFarland was chosen permanent chairman and it was voted that he appoint the necessary committees for the organization of the work.

The Society has received a very cordial invitation from the Washington Society of Engineers to hold its convention in Washington. They have appointed the following committee to coöperate with the Local Committee of our Society: W. A. McFarland, A. H. Raynal, W. E. Schoenborn, W. B. Upton, Mem. Am. Soc. M. E.; H. W. Fuller, Mem. Am. Inst. E. E.; John C. Hoyt, Assoc. Mem. Am. Soc. C. E.; D. S. Carll, Mem. Am. Soc. C. E.

The Society has also received the following invitation from the University Club of Washington:

Mr. Calvin W. Rice, Secy.
American Society of Mechanical Engineers
29 West 39th Street, New York

Dear Sir:

In connection with the spring meeting of the Society of which you are Secretary, which has been announced to be held in Washington, D. C., I beg to extend

to the Society through you an invitation on behalf of the University Club of Washington to make the club your headquarters for committee meetings, informal receptions and as a general bureau of information.

I regret that the club building is not of sufficient size to invite the Society to hold its main meetings therein, but we will be glad to extend to all members of the Society the privileges of the club as guests.

Very truly yours,

(*Signed*) Proctor L. Dougherty
Chairman House Committee

A definite program cannot be announced in this issue of The Journal but it is hoped that it will be completed in season for publication in the April number.

On account of the many points of interest in Washington the members will be provided, through the kindness of the Washington members, a condensed handbook of the most interesting points in the city together with such information as to hours buildings are open, routes, etc., as will enable the guests of the convention to visit the places independent of parties. Excursions will also be organized and guides furnished so that members may look forward to a most profitable meeting.

The local headquarters will be at the New Willard Hotel and that hostelry has every intention of caring for most of the members, but it must be definitely understood that it cannot do so unless the members do their part by engaging rooms two weeks in advance. The Society cannot attend to the matter of engaging rooms for members at the hotel. As Congress will be in session, it is imperative that each member make arrangements for his accommodations as early as possible.

Monthly Meeting for February

The monthly meeting for February was held in the Engineering Societies Building on Tuesday evening, February 23, the subject for discussion being Safety Valves. This proved to be a subject in which there was unusual interest and the data presented by the several speakers were evidently appreciated. Until recently there have been no definite data upon the performance and capacities of safety valves and it is believed that the need of such information for engineers was so forcibly brought out at this meeting, that the results of other tests either under way or contemplated will be made available for engineers in the near future.

In spite of its being a rainy evening the meeting was well attended and speakers were present from several different cities, one coming

from Chicago, two from Boston, and others from Philadelphia, Hartford, Bridgeport, Albany and other places. The meeting was opened by Mr. Frederic M. Whyte, General Mechanical Engineer of the New York Central Lines, with a paper upon Safety Valves, giving special attention to locomotive practice. He was followed by Mr. L. D. Lovekin, Chief Engineer of the New York Shipbuilding Co., Camden, N. J., with a contribution relating to marine practice, by Mr. Philip G. Darling, Mechanical Engineer, Manning, Maxwell and Moore, upon Safety Valve Capacity, Mr. A. B. Carhart, Superintendent, Crosby Steam Gage and Valve Co., upon Safety Valve Springs, Mr. E. A. May, Engineer of the American Radiator Co., upon Low Pressure Practice, and other prominent engineers.

Over twenty engineers participated in the discussion, some having carefully prepared manuscripts, and a number of contributed discussions were sent by engineers who were unable to be present.

Meeting of the Engineering Profession on the Conservation of Natural Resources, March 24, 1909

In place of the regular meeting of the Society in March there will be a meeting under the auspices of the four national engineering societies; the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers, and this Society, on the general subject of the Conservation of Natural Resources. All engineers and the public are invited.

The following program has been arranged and will be presented by representatives of the four Societies:

The American Society of Civil Engineers, The Conservation of Water, by John R. Freeman.

The American Institute of Mining Engineers, The Conservation of Natural Resources by Legislation, by Dr. Rossiter W. Raymond, Sec. A. I. M. E.

The American Society of Mechanical Engineers, The Waste of our Natural Resources by Fire, by Charles Whiting Baker, Mem. Am. Soc. M. E.

The American Institute of Electrical Engineers, Electricity and the Conservation of Energy, by Lewis B. Stillwell, Mem. A. I. E. E.

The committee of our Society assisting in the arrangement of the meeting consists of Geo. F. Swain, *Chairman*, Charles Whiting Baker, L. D. Burlingame, M. L. Holman and Calvin W. Rice.

GENERAL NOTES

THE HUDSON-FULTON CELEBRATION

The program for the celebration of the centenary of the opening of steam navigation by Robert Fulton on the Hudson River, and for the third centenary of the discovery of the river by Henry Hudson, has been announced. The entire Hudson valley will take part in this celebration, which will begin September 25 and continue until October 9. There is to be a naval parade up the river, among the participants in which will be a facsimile of Fulton's first steamboat, the Clermont, and a facsimile of Hudson's Half-Moon, the first ship to enter the river. This facsimile of the Half-Moon is now being built by the people of Holland.

THE GAS POWER SECTION

At the meeting of the Gas Power Executive Committee, January 27, the Meetings, Membership, Literature, Installations and Plant Operations Committees were appointed for the year 1909. A list of the committees is given in another department.

The work of these committees is already under way, and it is expected that considerable work will have been completed before the Spring Meeting. The Meetings Committee has secured a few good papers, and several more are promised. None of these however are sufficiently advanced to publish at this time. The Membership Committee with its enlarged personnel has completed its organization and good results are being obtained.

The Nominating, Accident and Tellers Committees will be announced later.

ACTIVITIES OF THE STUDENT BRANCH OF STEVENS INSTITUTE

The Student Branch of Stevens Institute of Technology has adopted a Constitution and has begun very active meetings. A series of general lectures was opened by Calvin W. Rice, Secretary Am. Soc. M. E., on Engineering as a Vocation; and other addresses have been made by Mr. Geo. L. Fowler, Member Am. Soc. M. E., upon

Locomotives and their Latest Improvements; by Mr. C. J. Armstrong, Consulting Engineer of the Singer Building, on Skyscrapers; by Mr. Ferdinand Stark of the Camera Club of New York, on Photography; by Dr. Pond on Commercial Manufacture of Sulphuric Acid, and by Professor Ganz on Electrolysis. They have also made several inspection trips.

Lectures in advance have been scheduled as follows: The Conservation of the Natural Resources of America, by a member of the National Commission, Washington, D. C.; The Conquest of the Air, Messrs. Post and Guy, Aëro Club of America; Wireless Telegraphy, Dr. Fred Vreeland, M.E.

In connection with the work of the Branch the students have organized an employment bureau for the purpose of assisting students to obtain positions during summer vacations and to enable them to use their spare time during the college year in some useful and remunerative occupation.

COMMITTEE OF AWARD SMITHSONIAN INSTITUTION

Prof. John A. Brashear, lately elected Honorary Member of this Society, is one of the Committee of Award appointed by the Regents of the Smithsonian Institution, controlling the award of the Hodgins Gold Medal for the promoting of Aërodromics and Aviation.

Other members of the Committee are, Octave Chanute, Chairman, Alexander Graham Bell, Major George O. Squier and James Means.

Members of the Society will recall that the John Fritz medal was conferred upon Dr. Bell at the dedication of the Engineering Societies Building in 1907, and that Major George O. Squier presented a very exhaustive paper upon aëronautics at the last annual convention.

PAST-PRESIDENT OF THE SOCIETY ON THE ASSAY COMMISSION

Mr. Ambrose Swasey, Past-president of the Society, was appointed by President Roosevelt on the Annual Assay Commission, to examine and test the fineness and weight ot the coins reserved by the several mints of the United States during the year 1908.

The members of the Commission met in Philadelphia February 10, for the purpose of counting, weighing and assaying the sample coins which had been set apart as representing the gold and silver pieces coined at the several mints during the past year.

PROFESSOR OF CIVIL ENGINEERING AT HARVARD

Prof. Geo. F. Swain, for several years Professor of Civil Engineering, Massachusetts Institute of Technology, has received the appointment of Professor of Civil Engineering at the Engineering School at Harvard. Professor Swain is a graduate of the Institute of Technology and supplemented his studies by three years at the Royal Engineering School at Berlin. He became instructor in the Institute in 1881 and since 1887 has been professor of civil engineering there. From 1880 to 1884 he was an expert on water power for the tenth census. In 1887 he was appointed consulting engineer of the Massachusetts Railroad Commission and has exerted a marked influence on railway bridge work and as engineer on numerous special commissions on elimination of grade crossings, etc. He has been a member of the Boston Transit Commission since its organization in 1894 and has carried on a private engineering practice mainly on bridge work. He is Vice-President of the American Society of Civil Engineers and Chairman of the Committee on Cement Tests in that Society, and is Chairman of the Committee on Conservation of Natural Resources of this Society.

MEMBER AM. SOC. M. E. PRESIDENT CHAMBER OF COMMERCE IN PARIS

M. Laurence V. Benet, Mem. Am. Soc. M. E., who has represented the Society upon several occasions in Paris, France, has been reëlected President of the American Chamber of Commerce in that city. Since the founding of the Chamber of Commerce in 1894, a president has not held office for a longer period than two terms of one year each. To M. Benet, who has already served two terms, reëlection comes as a special compliment.

MUSEUM OF SAFETY AND SANITATION IN THE ENGINEERING SOCIETIES' BUILDING

The executive office for the administrative and promotive work of the Museum of Safety and Sanitation has been opened in the Engineering Societies' building. Prof. F. R. Hutton, Honorary Secretary of the Society, is chairman of the committee on plans for the association and scope of its work.

The other members of the committee are Dr. Thomas Darlington, of the Health Department of the city of New York, P. T. Dodge, president of the Engineers Club, William J. Moran, attorney-at-law,

and Henry D. Whitfield, architect. Mr. Frank A. Vanderlip has accepted the office of treasurer. Mr. Charles Kirchoff, Mem. Am. Soc. M. E., editor of The Iron Age, is chairman of the committee of direction, T. C. Martin, editor of The Electrical World, vice-chairman, and Dr. William H. Tallman, director.

The society has for its aim the prevention of disablement and death by accident where safety devices for dangerous machines and preventable methods of combating dread diseases may be used.

WORLD CONFERENCE ON CONSERVATION

It was suggested by the North American conference on the conservation of natural resources, that the United States issue invitations to all the nations of the world to send delegates to an international world conference on conservation to be held at The Hague next September. The President immediately accepted the suggestion, and Secretary of State Bacon began the preparation of the invitations which will be issued as early as possible.

Delegates from Mexico and Canada and the United States attended the international congress, and those assembled in the East Room at the White House included members of the Cabinet, Justices of the Supreme Court of the United States, representatives of foreign governments, senators, representatives, members of the National Conservation Commission, representatives of the engineering societies and experts on the natural resources of the country.

The first result which the world conference would expect to obtain is a general inventory of the natural resources of the world, and of what has been done by the different nations in the way of conservation; the ways and means of securing proper use of the resources with a view to replenishing wherever possible, and to preventing waste of those which cannot be renewed.

INTERNATIONAL CONFERENCE AT THE WHITE HOUSE, FEB. 18, 1909

The International Congress on the Conservation of Natural Resources was held at the White House, February 18, 1909. The chairman of the Committee of the Society on the Conservation of Natural Resources, Professor Swain, Chairman of the Meetings Committee, Mr. Willis E. Hall, and the Secretary, attended the conference of the delegates from Canada, Mexico and the United States. President Roosevelt in addressing the assembled delegates said in part:

I feel, that this conference is one of the important steps that have been taken of recent years looking towards the harmonious coöperation between the nations of the earth for the common advancement of all.

In international relations I think that the great feature of the growth of the last century has been the mutual recognition of the fact that instead of its being normally to the interest of one nation to see another depressed, it is normally to the interest of each nation to see the others uplifted. I believe that the movement which you initiate is of the utmost importance to this hemisphere and may be of the utmost importance to the world at large.

I am anxious to do all in my power to work in harmony for the common good of all instead of each working to get something at the expense of the other. Ultimately, each of us will profit immeasurably if instead of striving to advance by trampling down the other all strive to advance together for the common advancement.

This is peculiarly an engineering problem and must be worked out by engineers, having in mind the public good solely and the permanent greatness of our country. Surely our Society could not be engaged in a more useful work.

At the request of the National Commission our Society has appointed an advisory committee consisting of Geo. F. Swain, J. R. Freeman and Chas. T. Main, with whom the Government is conferring in connection with water powers. The above gentlemen have made personal sacrifice to represent the Society and to attend to this patriotic duty.

INDUSTRIAL EDUCATION

A commission was appointed by the state legislature last April to investigate industrial education, and it has just submitted its report. The method employed by the committee was the sending out of letters to employers and employees throughout the state. Replies were received from over 2000 firms employing about 250,000 people. All of these replies expressed the need for industrial schools of some kind, but the consensus of opinion was against trade schools,—that is, schools in which shop work predominates. Their objections are largely based upon the belief that such schools would be too expensive, and would reach but a comparatively small percentage of the population. There is also an objection to the partial-time school; the reason given being that this system would disorganize factories and shops.

New Jersey was the first state in the union to make provision for industrial schools, as is pointed out in the report. It began by the passage of a law in 1881, and the movement has developed into the Newark Technical School, the Trenton School of Industrial Art and the Industrial School of Hoboken.

The report shows that the following states have taken legislative action: Massachusetts, New York, Wisconsin, Connecticut, Georgia, Alabama and Oklahoma. In Massachusetts over 2500 pupils are already enrolled in industrial schools. Alabama has nine schools and Georgia has eleven district agricultural schools.

PRESIDENT OF THE UNIVERSITY OF MICHIGAN RESIGNS

James Burrell Angell, LL.D., has submitted his resignation of the Presidency of the University of Michigan to take effect next June. The Board of Regents created the office of Chancellor and offered it to Dr. Angell at a salary of $4000 a year, together with the continued use of the President's mansion on the university campus.

Dr. Angell, who on Jan. 7 last celebrated his eightieth birthday, has directed the growth of the University since 1871, when he came from the Presidency of the University of Vermont. The University of Michigan had then 1110 students; the attendance has now reached 4780.

ANNUAL DINNER OF THE ALUMNI OF STEVENS INSTITUTE

Among those who spoke at the annual dinner of the Alumni of Stevens Institute of Technology held in New York, February 19, were the following: Mr. Alex. C. Humphreys, Mem. Am. Soc. M. E., President of Stevens Institute, Mr. Alfred Noble, Mem. Am. Soc. M. E., Past-President, Mr. H. G. Prout, and Mr. John A. Bensel.

OTHER SOCIETIES

CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION

The Annual Convention of the American Foundrymen's Association and allied bodies, including the Foundry and Manufacturers Supply Association, the American Brass Founders Association and the Associated Foundry Foremen, will be held in Cincinnati, with Hotel Sinton as headquarters, May 18, 19 and 20. Exhibits of foundry equipment and supplies, conducted by the Foundry and Manufacturers Supply Association will be open for inspection the entire week of May 17, in the Music Hall.

ANNUAL MEETING OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS

The 23d annual meeting of the Canadian Society of Civil Engineers was held at Toronto, in the King Edward Hotel, on January 28, 29 and 30 with President Galbraith and Secretary McLeod as the presiding officers.

Reports of the year's work of the Toronto, Quebec and Winnipeg branches of the society were presented. Printed reports of the Council and of committees for the past year were submitted for discussion. After the annual luncheon the report of the Committee on the Establishment of Testing Laboratories was submitted.

The society met at 7.30 p.m. in the convocation hall of Toronto University to listen to an interesting address by the retiring president, Dr. John Galbraith, upon the education and duties of the engineer. After Dr. Galbraith had been thanked for his efficient administration of the society affairs in the past year, the members became the guests of the undergraduates of the Faculty of Applied Science of the University at the 20th annual dinner. A handsome service of silver was presented by the students to Dr. Galbraith.

On Friday, January 29, there was an excursion to Port Colborne and Welland. In the evening the annual dinner of the society was given in the King Edward Hotel. On Saturday, the election of officers for the coming year was held and the business of the meeting concluded. The following officers were elected:

President, Geo. A. Mountain, of Ottawa.

Vice-Presidents: G. J. Desbarats of Quebec, H. N. Ruttan of Winnipeg, W. F. Tye of Montreal.

Members of Council: C. R. Contlee of Ottawa, F. W. W. Doane of Halifax, A. E. Douncet of Quebec, N. J. Ker of Ottawa, R. S. Lea of Montreal, J. G. Legrand of Montreal, Duncan MacPherson of Ottawa, R. A. Ross of Montreal, J. E. Schwitzer of Winnipeg.

MOVEMENT FOR ESTABLISHMENT OF TESTING LABORATORIES IN CANADA

At the annual meeting of the Canadian Society of Civil Engineers, the report of a committee on the establishment of testing laboratories was submitted. They recommended that the Dominion government be approached with reference to the establishment of a department of research similar to that lately established by the American government under the United States Geological Survey, in order to investigate the properties of all materials of engineering interest, whether in the raw or manufactured form.

Pending the establishment of a national laboratory of research by the government, the society suggested that arrangements might be made with universities of Canada whereby their staffs and equipment may be utilized to some extent for the purpose.

The committee closed their report by the expression of a belief that the encouragement of such laboratories will materially assist in the development of the natural resources of Canada.

The address of the retiring president, Dr. John Galbraith, was upon the education and duties of the engineer.

WESTERN SOCIETY OF ENGINEERS

At the February 3d meeting of the Western Society of Engineers, held in the society's rooms in Chicago, Mr. Horace E. Horton presented a paper on Water Storage in Elevated Tanks and Stand-Pipes, which was discussed by Messrs. T. W. Snow, Whyte, Naylor, Storey, W. W. Curtis and C. B. Burdick.

ANNUAL MEETING OF ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS

The annual meeting of the Illinois Society of Engineers and Surveyors was held January 27 to 29, at the Great Northern Hotel, Chicago, Ill. The annual presidential address was delivered by Mr.

Charles B. Burdick, on the subject of Government Control of Public Utilities, and reviewed the growth of these utilities and the resultant problems. The necessity of government control was pointed out, especially where questions of public health are concerned, as in the case of water supply and sewage systems. The report of the Committee on Sewers reviewed the competition between pipe, brick and concrete as materials for sewer construction. This report was followed by papers on Sewers. After the reading of several miscellaneous papers, the report of the Committee on Water-Works was presented, followed by a paper on the Lake View Pumping Station (Chicago).

Papers on Streets and Roads were also presented, and the report of the Committee on Roads and Pavements was accompanied by detailed tables as to the use of different kinds of fillers for brick paving. Reports were also submitted by the Committee on Drainage, the Committee on Railways and a special committee on Engineering Investigations.

The following were elected officers for the coming year: President, John B. Hittell; Vice-President, John W. Woermann; Secretary, E. E. R. Tratman.

THE AUTOMOBILE CLUB OF AMERICA

The Automobile Club of America held a session of their Fourth Annual Meeting in the rooms of the Society in the Engineering Societies Building; the invitation to use the Society's headquarters being extended by Professor F. R. Hutton, Honorary Secretary.

Mr. Henry Souther, Mem. Am. Soc. M. E., had charge of a running series of dynomometer tests on the club's apparatus during the convention. Papers were presented on the Economics of Weight Reduction by F. B. Howell, Mem. Am. Soc. M. E., and An Improved Type of Compression Coupling, by W. S. Noyes, Mem. Am. Soc. M. E.

At the Annual Banquet, Mr. Jesse M. Smith, Pres. Am. Soc. M. E., was a special guest. Seventy-seven members and guests of the Automobile Club attended, the largest number that has ever been present at the yearly gatherings. Other members of this Society present were: Henry Hess, A. L. Riker, Prof. R. C. Carpenter, Henry Souther, John Wilkinson, H. E. Coffin, C. S. Mott, C. E. Davis, Henri G. Chatain, A. H. Raymond, and Bruce Ford.

ANNUAL MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

The annual meeting of the American Society of Civil Engineers was held on Jan. 20 at the house of the Society in New York, Mr. Charles Macdonald, presiding.

It was announced that the annual convention would be held in the Mt. Washington Hotel, Bretton Woods, N. H.

The secretary announced the appointment and organization of the special committee to report on the design, ultimate strength and safe working values of steel columns and struts. Among the members of this committee, the following are members of this Society: Mr. A. L. Bowman, *Chairman*, Mr. A. P. Boller and G. F. Swain. The Chairman of the Committee presented resolutions stating that no testing machine of sufficient size to make full-size tests of large compression members is in existence; that such a machine and tests are beyond the means of private interests; that the work could best be carried on by the Government, and asking that the latter be requested to proceed with the construction of such a machine. The resolution was adopted and copies voted to be sent to the President and Vice-President of the United States and the Speaker of the House of Representatives.

The following officers were elected: President, Onward Bates; Vice-Presidents, George H. Pegram and Emil Swensson; Treasurer, Joseph M. Knap; Directors, Francis L. Stuart, Samuel C. Thompson, William G. Wilkins, Arthur N. Talbot, William N. Gardner, and Horace A. Sumner.

MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The February meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies Building, New York, February 19, 1909. The secretary announced the election of 88 associate members.

Owing to the illness of Dr. Charles P. Steinmetz, consulting engineer of the General Electric Company, his paper entitled Prime Movers, was presented by Mr. Ernst J. Berg. Most of the discussion was contributed by Prof. Charles E. Lucke, of Columbia University, and Mr. Henry W. Longwell, of the Westinghouse Machine Company at East Pittsburg. Both Messrs. Lucke and Longwell freely criticised the subject matter of the paper, saying, in brief, that the authoritative statements in the paper were not new and that the other statements were inconclusive. Mr. Calvert Townley, of the New York,

New Haven & Hartford Railroad Company, in discussing the part of the paper relating to hydraulic motors, deplored the agitation now centering at Washington, D. C., to place all valuable water powers under federal control. In Mr. Townley's opinion the cost of developing and maintaining hydraulic power plants and the net revenue therefrom, are not such as to justify burdensome federal restrictions.

MEETINGS TO BE HELD IN THE ENGINEERING SOCIETIES BUILDING

The following meetings will be held in the Engineering Societies Building during February and March.

Date		Name	Secretary	Time
Mar.	2	N. Y. Society Accountants & Bkprs.	T. L. Woolhouse	8:00
"	4	Blue Room Engineering Society	W. D. Sprague	8:00
"	5	Explorers Club	H. C. Walsh	8:30
"	9	N. Y. Soc. of Accountants & Bkprs.	T. L. Woolhouse	8:00
"	9	American Soc. of Mech. Engrs.	Calvin W. Rice	8:00
"	10	Illuminating Engineering Society	P. S. Millar	8:00
"	12	American Inst. of Electrical Engrs.	R. W. Pope	8:00
"	16	N. Y. Soc. of Accountants & Bkprs.	T. L. Woolhouse	8:00
"	16	N. Y. Telephone Society	T. H. Laurence	8:00
"	19	N. Y. Railroad Club	H. D. Vought	8:15
"	23	American Geographical Society	A. A. Raven	8:00
"	23	N. Y. Soc. of Accountants & Bkprs.	T. L. Woolhouse	8:00
"	24	Municipal Engineer of N. Y.	C. D. Pollock	8:15
Apr.	1	Blue Room Engineering Society	W. D. Sprague	8:00
"	2	Explorers Club	H. C. Walsh	8:30
"	6	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	8	Illuminating Engineering Society	P. S. Millar	8:00
"	9	Amer. Institute of Electrical Engrs.	R. W. Pope	8:00
"	13	N. Y. Soc. of Accountant & Bkprs.	T. L. Woolhouse	8:00
"	13	Amer. Soc. of Mechanical Engineers	C. W. Rice	8:00
"	14	Optometrical Soc. of City of N. Y.	J. H. Drakeford	8:00
"	15	Musurgia Society	F. M. Frobisher	8:00
"	16	N. Y. Railroad Club	H. D. Vought	8:15
"	20	American Geographical Society	Geo. H. Hurlbut	8:00
"	20	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	20	N. Y. Telephone Society	T. H. Laurence	8:00
"	27	N. Y. Soc. of Accountants & Bkprs	T. L. Woolhouse	8:00
"	28	Municipal Engineers of N. Y.	C. D. Pollock	8:15

NECROLOGY

KENTON CHICKERING

Kenton Chickering, Vice-President of the Oil Well Supply Company, died December 9, 1908, at his residence in Oil City. He was born in Worcester, Mass., May 16, 1847, and received his education in the Massachusetts public schools.

In 1863 he became a dispatch bearer for General Clark of the United States commissary department in New York City, and remained in the Government service for a time after the war. In 1870 he represented Eaton and Cole, dealers in brass and iron goods, at Titusville, remaining with the company when it became Eaton, Cole and Burnham Company, with offices at Oil City. In 1878 Mr. Chickering was made secretary of the Oil Well Supply Company, Ltd., which was formed at this time. This new company absorbed the Eaton, Cole and Burnham Company and others. In 1891, when the Oil Well Supply Company was organized in its present corporate form, Mr. Chickering was elected Vice-President, the position which he held at the time of his death.

He patented a number of useful inventions in connection with oil well machinery, and planned the large manufacturing plant erected by the company in 1901–1902, known as the Imperial Works. He also designed a number of special machines to increase the output and improve the quality of product of the plant.

Mr. Chickering was very active in church, civic and fraternal organizations.

GEORGE W. WEST

George Washington West died at his home in Middletown, N. Y., December 24, 1908. He was born April 3, 1847, at Troy, N. Y., and received his early education in the public schools of that city. In 1865 he entered the service of the New York Central & Hudson River Railroad at Schenectady, as machinist, and was later made foreman and master mechanic, leaving this position to accept a similar one with the West Shore.

In 1886, he entered the employ of the New York, Lake Erie and Western, now the Erie, as master mechanic of the Mahoning division, was later transferred to the main shops at Meadville, Pa., and in 1888 to the Eastern division. From 1891 until the time of his death he held the position of superintendent of motive power of the New York, Ontario and Western.

Mr. West was past president of the American Railway Master Mechanics Association, a member and past-president of the New York Railroad Club, and past-president of the Central Railway Club. He was a member of the Masonic order and the order of Elks. The George W. West Association of Engineers at Carbondale was named for him. He was also a director of the First National Bank of Middletown, president of the Ontario and Western Savings and Loan Association, a member of the Middletown Club and a member of the Board of Water Commissioners.

WILLIAM S. HUYETTE

William S. Huyette was born in Blair, Neb., November 13, 1870, and was educated in the public schools of Detroit, Mich.

He began his shop experience in the drafting department of the Detroit Blower Company, under the management of his father. He was later engaged by the engineering firm of Gilbert Wilkes Company, Detroit, leaving their employ in 1897 to open an office for the Wickes Boiler Company in Milwaukee, Wis.

The following year, Mr. Huyette returned to Detroit, to take charge again of the business of the Gilbert Wilkes Company in the absence of Mr. Wilkes, who was commander of the Detroit Naval Militia during the Spanish-American War. Upon the return of Mr. Wilkes after the war, Mr. Huyette went back to his work with the Wickes Boiler Company, and opened their branch office in Chicago. He continued as manager of that office until his death, January 11, 1909.

His engineering work was chiefly with boiler installations, and he also designed and patented a gas engine and designed and built steel sail boats and motor boats.

He was a member of the National Association of Stationary Engineers, and of the Chicago Yacht Club.

WALTER MORRISON ALLEN

Walter Morrison Allen, works manager of the Warner & Swasey Co., died February 8 at his home in Cleveland, O. He was born in Bristol-

ville, O., December 14, 1866, and received his early education in the local schools of Cherryfield, Me.

He evinced an interest in mechanics early in life and when only sixteen years of age frequently went to the nearest railway station, a distance of thirty miles, to study and make drawings of the locomotives that passed that point. In 1885, he began work as an apprentice to the machinist's trade in the works of Messrs. Warner & Swasey. He was given special opportunities in the drafting room, and at the completion of his term of apprenticeship was kept in this department, of which he was made head in 1891. During the next two years, the details of the design and construction of the 26-in. telescope of the Naval Observatory and the 40-in. telescope of the Yerkes Observatory came largely under his direction.

In 1893 he had charge of the firm's exhibit at the Chicago exposition and during the following six years was superintendent of their works. In 1904 he was made works manager, the position which he held at the time of his death. He had traveled much in the interests of the company, visiting England and the Continent in 1897–1898 and again in 1900.

Mr. Allen was a member of Calvary Presbyterian Church, the Cleveland Engineering Society, the Cleveland Chamber of Commerce, the Colonial Club and the Automobile Club of Cleveland.

PERSONALS

Mr. Thomas D. Adams, formerly located at Southport, Conn., has accepted a position with Werner & Pfleiderer, Saginaw, Mich.

Mr. Chester B. Albree was elected one of the directors of the mechanical section of the Engineers' Society of Western Pennsylvania for the coming year.

Mr. L. M. Bannon has become assistant superintendent of the Union Bleaching and Finishing Co., Greenville, S. C. He was formerly associated with the Dexter Engineering Co., Providence, R. I., in the capacity of chief draftsman.

Mr. George H. Baush is no longer connected with Hill, Clarke & Co., as general manager. He has accepted a position with the Fay Machine Tool Co., Philadelphia, Pa.

Mr. John Birkinbine, Consulting Engineer, Philadelphia, Pa., has gone to Mexico to review the exploratory work which his son, J. L. W. Birkinbine, has carried on for a year and a half, for the Oaxaca Iron and Coal Co., Oaxaca, and to investigate railroad routes to make the coal and iron ore available. He will also look into some large hydro-electric improvements projected in the States of Oaxaca and Guerrero.

Mr. Henry A. Bogardus has organized Henry A. Bogardus & Co., with offices at 178 E. Huron St., Chicago, Ill. He was formerly connected with Jas. P. Marsh & Co., Chicago, as Manager.

Mr. David A. Chapman, recently with the Woonsocket Electric Machine & Power Co., Woonsocket, R. I. as supervising engineer, has become superintendent of the Estate of E. S. Converse Co., with office at 101 Milk St., Boston, Mass.

Mr. A. G. Christie, who was chief engineer of the Western Canada Cement and Coal Co., Exshaw, Alberta, Can., is now research assistant in steam engineering at the University of Wisconsin.

Mr. Charles O. Churchill has accepted a position with the Georgian Manufacturing Co., Binghamton, N. Y. He was formerly mechanical engineer of the valve department of the Fairbanks Co. of New York.

Mr. Howard E. Coffin has an article in the January 21 issue of The Automobile, on Impressions of an Automobile Engineer.

Mr. George N. Comly, who has been chief draftsman for the Solvay Process Co., for 14 years, has tendered his resignation to take effect March 1.

Mr. William W. Estes has acepted a position with the Taft-Pierce Co., Woonsocket, R. I., in the capacity of designer.

Mr. R. E. Fox, Jr., has recently been elected vice-president of The Engineer Company, New York. He was formerly secretary and sales manager of the company.

Mr. Herbert I. Gannett, formerly Manager of the Omaha, Neb., office of the Monarch Acetylene Co., is now vice-president and general manager of the Buffalo, N. Y., office.

Mr. James B. Haney, leading draftsman, office of Chief of Ordnance, U. S. A., Washington, D. C., will be located for some time at the McCundless Bldg., Honlulu, Hawaii.

Mr. William H. Hansell, until recently chief engineer of the Standard Roller Bearing Co., has opened an office with Mr. G. Edward Smith, in the Provident Bldg., Philadelphia, Pa., for consulting and contracting engineering. The firm name is Edward Smith Company.

Mr. Charles G. Herbert, Engineer, The Solvay Process Co., has removed from Detroit, Mich., to Syracuse, N. Y.

Prof. H. Wade Hibbard, formerly Professor of Mechanical Enginering of Railways, Sibley College, Cornell University, Ithaca, N. Y., has been appointed Professor of Mechanical Engineering, University of Missouri, Columbia, Mo.

The partnerships heretofore existing between Alexander C. Humphreys and Arthur G. Glasgow, both members of the Society, have been dissolved, owing to the decision to incorporate the firm of Humphreys & Glasgow of New York.

Dr. F. R. Hutton, Honorary Secretary of the Society, has revised and rewritten his text-book on The Mechanical Engineering of Steam Power Plants. The book gives a broad survey of the functions and general assembly of a power plant. This is its third edition.

Mr. Herman G. Jakobsson is no longer connected with the Bethlehem Steel Co. as chief ordnance draftsman but has entered the service of the Midvale Steel Co., Philadelphia, Pa.

Mr. James B. Ladd and David Baker have opened offices in the Real Estate Trust Bldg., Philadelphia, Pa., under the firm name of Ladd and Baker, and will carry on a general consulting and contracting engineering business.

Mr. J. S. Lane, formerly of the Webster, Camp & Lane Co., Akron, O., and consulting engineer in the city of New York, has lately become connected with The Engineer Company, Hudson Terminal Bldg., New York.

Prof. C. E. Lucke, head of the Department of Mechanical Engineering of the School of Mines, Engineering and Chemistry of Columbia University, spoke before the Society of Arts of the Massachusetts Institute of Technology, February 27, on the general subject of Gas Power.

The Railway Journal, in their January issue, publishes an extract of the paper on Articulated Compound Locomotives, presented at the Annual Meeting by C. J. Mellin.

The Water and Gas Review publish in their December number the paper on Reminiscences of a Gas Engine Designer, by L. H. Nash, presented at the Annual Meeting of the Society.

Mr. V. M. Palmer, until recently superintendent of the Smith Automobile Co., Topeka, Kans., has accepted a position as engineer with the Selden Motor Vehicle Co., Rochester, N. Y.

Mr. Charles E. Paul, formerly Assistant Professor of Mechanics and Materials, Pennsylvania State College, has been appointed Associate Professor of Mechanics at Armour Institute of Technology.

Mr. Edwin G. Rust, formerly Vice-President and general manager of the Elk Rapids Iron Co., Elk Rapids, Mich., has accepted a position with the Sheffield Coal and Iron Co., Sheffield, Ala.

Mr. Howard E. Satterfield, lately director of Winona Technical School, Indianapolis, Ind., is at present with the North Carolina College of Agriculture and Mechanic Arts, West Raleigh, N. C.

Mr. Samuel B. Sheldon, formerly associated with the Lackawanna Steel Co., Buffalo, as General Superintendent, has entered the service of the Bethlehem Steel Co., Saucon Works, in the same capacity.

Mr. Henry Souther, of Hartford, Conn., will devote considerable of his time to the interests of the Standard Roller Bearing Co., Philadelphia, Pa., as consulting engineer.

Dr. Charles P. Steinmetz, Schenectady, N. Y., gave a lecture on The Future of Electricity before the Society of Arts of the Massachusetts Institute of Technology, Boston, on the evening of January 28.

Prof. George F. Swain, at present in charge of the Department of Civil Engineering at Massachusetts Institute of Technology, has been appointed Professor of Civil Engineering in the Graduate School of Applied Science of Harvard University.

Mr. T. H. Tracy, who until recently was with the Tracy Engineering Co., Los Angeles, Cal., is now President of the Tracy-Devereaux Co., with offices at 211–15 Kerchoff Bldg., Los Angeles, Cal.

A. S. Vogt, Mechanical Engineer for the Pennsylvania Railroad Company, has recently taken on eight draftsmen. This appears to be an indication of the return of the railroad activity which marked 1907.

Power and the Engineer and The Electrical Review and Western Electrician have republished the article on Fuel Economy Tests at a Large Oil Burning Electric Plant by C. R. Weymouth, published in The Journal, and presented at the Annual Meeting.

Mr. Oliver B. Zimmerman has entered the employ of M. Rumely Co., La Porte, Ind., as chief draftsman. He was until recently associated with Hart-Parr Co., Charles City, Ia., in the same capacity.

THE JOURNAL

OF

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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THE JOHN FRITZ MEDAL AWARD

TUESDAY EVENING, APRIL 13

Tuesday evening, April 13, will be the occasion for publicly conferring the John Fritz Medal upon Mr. Chas. T. Porter, Honorary Member of the Society.

The ceremony will be held under the auspices of the John Fritz Board which is made up of representatives from the American Society of Civil Engineers, the American Institute of Mining Engineers, The American Society of Mechanical Engineers and the American Institute of Electrical Engineers, thus representing the entire engineering profession. It will take place in the large auditorium of the Engineering Societies Building, No. 29 West 39th Street, New York. It is the wish of the Board to give distinction to the event, and to make these awards year by year memorable and fittingly conspicuous. Besides the simple ritual of the presentation of the medal, in the presence of invited guests and distinguished representatives of engineering, there will be addresses by representatives of the four groups of the profession most concerned.

The medal was established in 1902 to perpetuate the memory of the achievements of John Fritz, Honorary Member and Past President, Am. Soc. M. E. It is awarded for notable scientific or industrial achievement.

Previous awards have been, to Lord Kelvin for his work in the development of the telegraph, and other scientific achievements; to

George Westinghouse, Hon. Mem. Am. Soc. M. E., for the invention and development of the air brake; to Alexander Graham Bell for his invention and development of the telephone. It will be awarded to Charles T. Porter for his part in the origination of the high speed steam engine.

Members, ladies and the public are invited.

PROGRAM

Tuesday Evening, April 13, at eight-thirty

In the Engineering Societies Building,
29 West 39th St., New York

Ceremony Conferring

THE JOHN FRITZ MEDAL

upon

CHARLES T. PORTER, HONORARY MEMBER, AM.SOC.M.E.

For his part in the origination of the high speed steam engine

Henry R. Towne, Past Pres. Am. Soc. M. E., Presiding Officer

THE DEBT OF MODERN INDUSTRIAL CIVILIZATION TO THE STEAM ENGINE

Address by Dean W. F. M. Goss, Mem. Am. Soc. M. E.

Presentation of Medal

THE DEBT OF THE MODERN STEAM ENGINE TO CHARLES T. PORTER

Address by Dr. F. R. Hutton, Honorary Secretary, Am. Soc. M. E.

DEBT OF THE ERA OF STEEL TO THE HIGH-SPEED STEAM ENGINE

Address by Robert W. Hunt, Mem. Am. Soc. C. E., Past President Am. Inst. M. E. and Am. Soc. M. E.

THE DEBT OF THE ERA OF ELECTRICITY TO THE HIGH-SPEED STEAM ENGINE

Address by Frank J. Sprague, Past-President, Am. Inst. E. E., Mem. Am. Soc. C. E.

Distinguished invited guests will occupy seats upon the platform.

THE WASHINGTON MEETING

LOCAL COMMITTEE

WALTER A. McFARLAND, *Chairman*

GUSTAV AYRES
ALBERT H. BUCKLER
CHARLES ELI BURGOON
GORDON CAMPBELL
HOWARD A. COOMBS
JAMES B. DILLARD
WILLIAM A. E. DOYING
CHARLES E. FOSTER
H. A. GILLIS
JAMES HAMILTON
FREDERICK E. HEALY
HERMAN HOLLERITH
J. A. HOLMES
ARTHUR E. JOHNSON
FRANK B. KING
HERVEY S. KNIGHT
WALTER R. METZ
GEORGE L. MORTON
HAROLD P. NORTON
WILLARD L. POLLAND
JOHN E. POWELL
ALFRED H. RAYNAL
WILLIAM B. RIDGELY
W. E. SCHOENBORN
GEORGE R. SIMPSON
CHARLES F. SPONSLER
LUCIEN N. SULLIVAN
WILLIAM B. UPTON
CHARLES V. C. WHEELER
EARL WHEELER

COMMITTEE OF WASHINGTON SOCIETY OF ENGINEERS

W. A. McFARLAND, Mem. Am. Soc. M. E., *Chairman.*
A. E. JOHNSON, Mem. Am. Soc. M. E.
A. H. RAYNAL, Mem. Am. Soc. M. E.
W. E. SCHOENBORN, Mem. Am. Soc. M. E.
W. B. UPTON, Mem. Am. Soc. M. E.
H. W. FULLER, Mem. Am. Inst. E. E.
JOHN C. HOYT, Mem. Am. Soc. C. E., Secretary, Washington Soc. Engrs.
D. S. CARLL, Mem. Am. Soc. C. E., President, Washington Soc. Engrs.

The Society is indebted to the Meetings Committee, to the Local Committee of Washington and to the Washington Society of Engineers for the following delightful program. The Society also wishes to acknowledge the honor shown in appointing as a Reception Committee men representing each of the National Engineering Societies.

Tuesday, May 4

8.15 p.m.

Informal reception at the New Willard Hotel.

Address of welcome by Hon. Henry B. F. Macfarland, President of the Board of District Commissioners.

Response by Mr. Jesse M. Smith, President of the Society.

Wednesday, May 5

Professional session at 9.15 a.m

Sight-seeing automobile trips about the city at 10 a. m. for the ladies.

Reception of members and their guests by the President of the United States in the East Room of the White House at 2.30 p.m.

Trips to near-by points of interest at 4 p.m.

Illustrated lecture by Mr. F. H. Newell, Director of the Reclamation Service on "Home-Making in the Arid Regions," at 8.15 p.m.

Thursday, May 6

Short professional session at 9.15 a.m.

Trips for the Ladies to points of interest in and about the city at 9.15 a.m.

Special exhibition drill by troops at Fort Myer at 2.00 p.m.

Social reunion. Address by Rear-Admiral Melville on "The Engineer in the Navy," at 8.15, to be followed by presentation to the National Gallery of a portrait of Rear-Admiral Melville, with acceptance by Dr. C. D. Wolcott, representing the nation.

Friday, May 7

Professional session at 9.15 a.m.

CONVENTION NOTES

The reception of the members and guests by President Taft will be one of the pleasant functions of the convention.

The address by F. H. Newell, Director of the U. S. Reclamation Service, will be of extraordinary interest. Mr. Newell is in a position to command a large view of this important branch of the government's work of reclamation and the lecture will be illustrated by colored lantern slides showing marvelous transformations of arid regions into beautiful and fertile home-sustaining lands

It is possible that during the convention there may be an ascension of a dirigible balloon and an aëroplane. If so, the Secretary of War, Mr. J. M. Dickinson, proposes, provided the conditions are favorable, to invite the members and guests. Those who attended the addresses on aëronautics at the time of the annual meeting given through the courtesy of Brig-Gen. Allen, Major Geo. O. Squier and Lieut. Frank P. Lahm, and saw the wonderful moving pictures of dirigible balloons and aëroplanes in flight will realize in a measure the oppo - tunity for witnessing an actual ascension.

A very interesting feature will be two exhibition drills which will be given by the United States troops stationed at Fort Myer. These will be held in the open field or in the riding hall, according to the condition of the weather, so that in any event the convention guests may depend upon seeing the drill in comfort.

On Thursday evening, the address by Past-President Geo. W. Melville, Rear-Admiral, Retired, and former Engineer-in-Chief of the Navy, on "The Engineer in the Navy," will undoubtedly prove highly interesting, as Rear-Admiral Melville is a noted speaker. Upon this evening there will be a presentation to the National Gallery of a portrait of Rear-Adm. Melville, painted by Sigismond de Ivanowsky. It will be received for the National Gallery by Dr. Chas. D. Wolcott, Secretary of the Smithsonian Institution. The portrait is presented by friends and admirers of Rear-Admiral Melville.

It is unnecessary to emphasize the pleasure and instruction of visiting the places of interest in Washington. The fact that Congress will be in session at that time is an added attraction.

RAILROAD TRANSPORTATION NOTICE

Arrangements for hotel, transportation and Pullman car accommodations should be made personally.

Special concessions have been secured for members and guests attending the Spring Meeting in Washington, May 4–7, 1909.

The special rate of a fare and three-fifths for the round trip, on the certificate plan, is granted when the regular fare is 75 cents and upwards, from territory specified below.

a Buy your ticket at full fare for the going journey, between April 30 and May 6 inclusive. At the same time request a certificate, *not a receipt.* This ticket and certificate should be secured at least half an hour before the departure of the train.

b Certificates are not kept at all stations. Find out from your station agent whether he has certificates and through tickets. If not, he will tell you the nearest station where they can be obtained. Buy a local ticket to that point, and there get your certificate and through ticket.

c On arrival at the meeting, present your certificate to S. Edgar Whitaker, office manager at the Headquarters. A fee of 25 cents will be collected for each certificate validated. No certificate can be validated after May 7.

d An agent of the Trunk Line Association will validate certificates May 5, 6 and 7. No refund of fare will be made on account of failure to have certificate validated.

e One hundred certificates must be presented for validation before the plan is operative. This makes it important to ask for certificate, and to turn it in at Headquarters. Even though you may not use it this will help others to secure the reduced rate.

f If certificate is validated, a return ticket to destination can be purchased, up to May 11, on the same route over which the purchaser came, at three-fifths the rate.

This special rate is granted only for the following:

The Trunk Line Association:

All of New York east of a line running from Buffalo to Salamanca, all of Pennsylvania east of the Ohio River, all of New Jersey, Delaware and Maryland; also that portion of West Virginia and Virginia north of a line running through Huntington, Charleston, White Sulphur Springs, Charlottesville, and Washington, D. C.

The Central Passenger Association:

The portion of Illinois south of a line from Chicago through Peoria to Keokuk and east of the Mississippi River, the States of Indiana, and Ohio, the portion of Pennsylvania and New York north and west of the Ohio River, Salamanca and Buffalo, and that portion of Michigan between Lakes Michigan and Huron.

The New England Passenger Association, except via Bangor and Aroostook R. R., Rutland R. R., N. Y. O. & W. R. R., Eastern Steamship Co. and Metropolitan Steamship Co.

Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut.

The Western Passenger Association offer revised one-way fares to Chicago, Peoria and St. Louis; these three places are points in the Central Passenger Association, and from these points purchase round trip tickets, in the manner outlined in the preceding paragraphs:

North Dakota, South Dakota, Nebraska, Kansas, Colorado, east of a north and south line through Denver, Iowa, Minnesota, Wisconsin, Missouri; north of a line through Kansas; Jefferson City and St. Louis, Illinois; north of a line from Chicago through Peoria to Keokuk.

The Eastern Canadian Passenger Association:

Canadian territory east of and including Port Arthur, Sault Ste. Marie, Sarnia and Windsor, Ont.

TRAIN SCHEDULES

The following trains are suggested, via Pennsylvania Railroad.

Lv. New York, Tuesday, May 4	10.55 a.m.
Lv. North Philadelphia	1.00 p.m.
Lv. Baltimore	3.12 p.m.
Ar. Washington	4.15 p.m.
Lv. New York, Wednesday, May 5	12.10 a.m.
Lv. Baltimore	6.01 a.m.
Ar. Washington, Wednesday, May 5	7.12 a.m.
Lv. St. Louis, Monday, May 3	12.45 p.m.
Lv. Chicago	3.15 p.m.
Lv. Indianapolis	7.20 p.m.
Lv. Detroit	8.05 p.m.
Lv. Cincinnati	9.00 p.m.
Lv. Cleveland	11.30 p.m.
Lv. Columbus, Tuesday, May 4	12.45 a.m.
Lv. Pittsburg	7.30 a.m.
Lv. Baltimore	5.15 p.m.
Ar. Washington	6.22 p.m.

HOTEL ACCOMMODATIONS

Members should bear in mind that Congress will be in session at the time of the convention, and also that this is the most delightful season of the year in Washington. As a result the city has many visitors and a consequent large demand on its hotel accommodations. Members expecting to attend the convention should engage rooms immediately.

The letter from the hotel assigning rooms should be preserved, and presented at the time the rooms are demanded. Two days before arriving in Washington, the hotel should be notified of the exact time of expected arrival, referring to the letter engaging rooms. If one hotel cannot provide satisfactory accommodations, immediate correspondence with others will doubtless secure what is desired.

Hotel Rates for Spring Meeting at Washington
Minimum Rates

	American Plan				European Plan			
	without bath		with bath		without bath		with bath	
	Single Room	Double Room	Single Room	Double Room	Single Room	Double Room	Single Room	Double Room
New Willard	.....	.....	.....	.....	2.50	4.00	3.50	5.00
Shoreham	5.00	9.00	5.50	10.00	2.50	4.00	3.00	5.00
Arlington	5.00	10.00	7.00	12.00	2.00	4.00	4.00	6.00
Raleigh	.....	.....	.....	.....	2.00	3.00	3.00	4.00
Ebbitt	2.50	5.00	4.50	7.00	.....	.....	.....	.....
St. James	.....	.....	.....	.....	1.50	2.00	2.50	3.50
Cochran	4.00	7.00	4.50	9.00	.....	.....	.....	.....
Riggs	3.00	6.00	4.00	8.00	.....	.....	.....	.....
Normandy	3.50	6.00	4.00	9.00	1.50	3.00	3.00	4.00

If baggage is to be sent by express, checks can be given the baggage expressman immediately upon arrival. Trolleys leave the station for all hotels. Automobile passengers are allowed only a very small steamer trunk; carriage passengers, one medium-sized trunk. Extra baggage can be managed by taking as many carriages as there are trunks, or by sending some pieces by baggage express. The traveler wishing an automobile or carriage should give his checks to the uniformed porter immediately upon arrival as no carriages will be assigned to travelers until their baggage has first been brought to the platform in front of the station.

THE MARCH MEETING

A particularly interesting occasion was the lecture on "Modern Physics," given by Dr. William Hallock, Professor of Physics, Columbia University, at the regular monthly meeting, Tuesday evening, March 9.

The lecture included a review of discoveries introductory to the X-ray, radio-activity and allied phenomena; experimental demonstration of different forms of radiation, including heat; development of the essential identity of radiant light, heat and Hertz waves, together with the evidence of the electro-magnetic nature of light radiations; differentiations between these forms of radiation and those of so-called radio-active material, followed by the bearing of the facts developed by radio-activity upon the possible genesis of the chemical elements; the kinetic theory of gases and its relation to the modern theory of solutions; the moving ion as the determining factor in electrical conduction; the distinction between the chemical and the physical ion; the atom and the relation of its structure to the phenomena of radiation and absorption; the principle of relativity and its relation to the structure of the atom and the electron; the universal application of the *force, mass, time* theory to molecular and cosmic phenomena.

JOINT MEETING ON CONSERVATION

The meeting of the national engineering societies on the conservation of our natural resources was held in the Engineering Societies' Building on the evening of March 24. Mr. Onward Bates, president of The Am. Soc. C. E., who was to have presided, was unable to attend, and Dr. James Douglas, past-president of The Am. Inst. M. E., acted as chairman. At the opening of the meeting, he announced a telegram from President Taft, which was read by Mr. John Hays Hammond, as follows:

THE WHITE HOUSE

WASHINGTON, March, 24.

JOHN HAYS HAMMOND,

Please say to Joint Engineering Societies that I am greatly gratified to know of their coöperation in the movement for the conservation of the natural resources of the country. The members of these societies, with their technical knowledge, are not only better advised as to the necessity for such conservation, but are more competent to suggest the methods by which such conservation can be carried out. I have already pledged the administration to as full support as possible of the policy, and I am glad to renew my expression of sympathy with the movement, and to state my high estimate of the value of the aid which can be rendered by the United Engineering Societies.

WM. H. TAFT.

In his opening remarks Dr. Douglas said that in a great movement of this kind there could be no dividing line between engineers in different branches of the profession. The great inventions like that of the Bessemer process had required a combination of the skill of engineers who had specialized in different fields. He said that in looking back we must be struck with the advance that had been made in the reduction of waste in the use of natural supplies, especially in saving coal, both in mining it and in using it in metallurgical work.

The first address was upon The Conservation of Water, by John R. Freeman, consulting engineer of the Department of Additional Water Supply for the City of New York. He spoke of the relation of stream flow to lumbering, emphasizing the importance of accurate stream measurements in order to obtain precise knowledge of the effect of forests and of the value of water powers. Interesting

figures were given, comparing the efficiency of turbines of the old days with those of the present time. Other phases of the conservation of water, such as the purity of the water courses, navigation, irrigation, etc., were considered. He recommended that the different states should collect facts regarding the notable opportunities for power development within their borders, making careful surveys, thus placing reliable information at the disposal of those inclined to take advantage of such natural opportunities for power.

The address of Dr. R. W. Raymond, Secretary of The American Institute of Mining Engineers, was upon Conservation by Legislation. He defined true conservation as the diminution, not of use but of waste. The best method for the prevention of waste lies in the progressive education of the people, rather than by legislation. He urged that government information pertaining to natural resources and their conservation should be collected with care and not hurried; and stated without bias or argument in favor of any measure or policy. Hasty and ill-considered legislation, especially if reduced by selfish interests, is a peril. He dealt with specific examples of such legislation and urged that the work of the departments of the Federal government should be carefully planned in advance instead of expanding without a definitely arranged plan.

Mr. Charles Whiting Baker, Editor of Engineering News, spoke on The Waste of our Natural Resources by Fire. He gave new statistics upon the fire laws in the United States, with the striking illustration that we are burning up every year in this country a street of buildings a thousand miles long that would reach from New York to Chicago. That this destruction is not necessary is proved by the experience of European countries where the per capita fire loss is in most cases only a few cents annually, while in this country it is $2.50. Referring to the destruction by forest fires, he said that effective laws for the protection of forests must be enacted before capital will be invested in the development or preservation of timber lands.

The last address was by Mr. Lewis B. Stillwell, Consulting Electrical Engineer, upon Electricity and the Conservation of Energy. He illustrated the function of electricity in the conservation of power resources by interesting figures, showing results accomplished in three typical cases, namely, the plants of the Niagara Falls Power Co., the Northeast Coast Power System at Newcastle-upon-Tyne, and the plants of the Interborough Transit Co., New York. The Niagara plant showed the possibility in water power development

and the Northeast Coast plant the economy resulting from the substitution of large steam-driven units for small steam plants, widely distributed. In the case of the Interborough Company, comparisons were made of the cost under the present system of electrical distribution and of the cost that would have obtained if locomotives had been used instead.

Among the guests at the meeting were Prof. Marsten T. Bogart, President of The American Chemical Society; Dr. James Douglas, Past-Pres. Am. Inst. M. E., and Pres. Phelps-Dodge Co.; John Hays Hammond, Past-Pres. Am. Inst. M. E.; Charles Wallace Hunt, Pres. United Engineering Society, Past-Pres. Am. Soc. M. E.; Charles Kirchhoff, Past-Pres. Am. Inst. M. E., Editor, "Iron Age;" Dr. Albert R. Ledoux, Past-Pres. Am. Inst. M. E.; John W. Lieb, Jr., Past Pres. Am. Inst. E. E., and Vice-Pres. and Asst. Gen. Mgr. N. Y Edison Co.: Dr. W. J. McGee, Secretary Inland Waterways Commission of the U. S. and Soil Expert of the Bureau of Soils; Geo. R. Pegram, Vice-Pres. Am. Soc. C. E., Mech. Engr. Interborough Rapid Transit Co.; Jesse M. Smith, Pres. Am. Soc. M. E.; Geo. W. Tillson, Vice-Pres. Am. Soc. C. E., Ch. Engr. Bureau of Highways, Manhattan.

A STANDARD METHOD OF TESTING REFRIGERATING MACHINES

A standard method of testing refrigerating machines, a preliminary report of which was published in the Proceedings of this Society in April 1907, was presented before the National Refrigeration Congress held in Paris, France, last year, by Dr. D. S. Jacobus, Mem. Am. Soc. M. E., and a member of the committee of this Society appointed for conducting these tests. Professor Jacobus is also a member of the American Society of Refrigerating Engineers, and he has recently called their attention to the report requesting free discussion and honest criticism of the committee's work, insisting that no one should refuse to offer such criticism with the idea that offense would be given. Professor Jacobus voices the opinion that the committee is most anxious to weed out all the weak portions and replace them by something better. He considers that this can be done only by the coöperation of engineers engaged in the refrigerating industry and especially those associated with this Society and with the Society of Refrigerating Engineers.

To aid and facilitate the report of the committee, Professor Jacobus, in a paper presenting the preliminary report to the International Refrigeration Congress in Paris, asked the following questions:

a Is it well to establish a standard set of conditions under which refrigerating machines should be tested, in order that the results obtained for one machine may be compared with those obtained with another?

b Is the standard set of conditions which have been set forth the most desirable to adopt, or could others be employed to advantage?

c Is it well to recommend that the tonnage capacity be based on the actual weight of refrigerating fluid circulated between the condenser and the refrigerator, and actually evaporated in the refrigerator, or would it be better to rely in all cases on the determination of the actual tonnage capacity generated by the machine as given by the actual weight of brine or other liquid refrigerated, and the range of temperature?

d Should the refrigerating capacity of a machine refer only to that part of the plant which has the ammonia or other primarily refrigerating fluid in circulation, or should it include the entire plant and in this way be affected by the capacity of the refrigerator or the refrigerating coils?

e Is the method proposed in the report for weighing the amount of anhydrous ammonia a good one, or would it be preferable to obtain the weight in some other way?

f What is the best method of determining the density of the liquid in an absorption machine? Where the liquid is very rich in ammonia it is impossible to draw it off at ordinary temperatures without allowing considerable of the ammonia to escape in the form of fumes. Would it be a good plan to pass the liquid through a coil placed in a freezing mixture and determine the density at

a much lower temperature than that usually employed and, if so, what temperature would be the best one to adopt?

g What is the best method of determining the purity of the anhydrous ammonia in a machine? In case the amount of moisture is to be determined, can this be done accurately by means of absorption tubes?

h In case water is found to be present in the ammonia, how can this be allowed for in computing the tonnage capacity on the basis of weight of the refrigerating fluid circulated?

i Would it be a good plan to rate refrigerating machines in regard to capacity in some way irrespective of results which may be obtained by tests? For example, would it be advisable to rate ammonia compression machines on the size of ammonia compression cylinders, or the displacement of the piston of the ammonia cylinder, or, on the other hand, should the rating of machines be left entirely to the manufacturers?

He said further in addition to these general questions:

There are a number of other important points that should be carefully considered, and the writer earnestly hopes that the matter will be gone into in a thorough way with a view to establishing a report which will be of value. If a report is not actually used in connection with the work which it outlines it is certainly a failure. The members of this society have use for a report on the subject at hand, and are better able than any other body of men to prepare it in the right way. Let us all pull together and see what we can do in this line in the light of the very latest experience, and establish something which we can conscientiously feel will be of service to the profession at large.

He also suggested the appointment of a joint committee of this Society and the Society of Refrigerating Engineers to consider the necessary rules and to form a report which will represent the careful investigation and judgment of the two societies.

The attention of the members is called to the preliminary report. If they have not the copy of the Proceedings containing this report the Society will be pleased to furnish it upon application. Any suggestions or criticisms sent to the Society will be forwarded promptly to the Committee.

THE LIBRARY

Many new and important books among the recent publications have been added to the Library of the Society.

The Library Committee of this Society, composed of Messrs. John W. Lieb, Jr., H. H. Suplee, Ambrose Swasey, Leonard Waldo, and Chas. L. Clarke, have selected the volumes listed below. These books have been received and catalogued. Of special interest are the reference books, which include many valuable works in English, French and German.

The members are requested to bear in mind that the library is constantly expanding and they are invited to use its resources freely and to encourage those who are not members of the societies to take advantage of its reference books and magazines.

The Library Committee are untiring in their efforts to expand the resources and to extend the usefulness of the Library.

Books

Art of Paper-Making, The, by Alexander Watt 1907
Boilers, Their History and Development, by H. H. Powles 1905
Chemistry of Gas Manufacture, by Harold M. Royle 1908
Concrete, its Uses in Building from Foundation to Finish, by Thomas Potter 1908
Cranes, Their Construction, Mechanical Equipment and Working, by Anton Rottcher 1908
Experimental Researches of the Flow of Steam Through Nozzles and Orifices, by A. Rateau 1905
Factory Manager, The, by Horace L. Arnold 1905
Flight-Velocity, by A. Samuelson 1906
Flying Machines, by A. W. Marshall and H. Greenley ....
Gas Engine Construction, by Henry V. A. Parsell and Arthur Weed 1900
Gas Engineer's Laboratory Handbook, The, by John Hornby 1902
Gas Power, by F. E. Junge 1908
Hydraulics and Its Applications, by A. H. Gibson 1908
Lathe Design for High and Low-Speed Steels, by John T. Nicolson 1908
Leather Manufacture, by Alexander Watt 1906
Manual of Reinforced Concrete and Concrete Block Construction, by Chas. F. Marsh 1908
Mercurial Air Pump, The, by Prof. Silvanus P. Thomson 1888
Modern Foundry Practice, by John Sharp 1905
Modern Gas Engines and Producer Gas Plants, by R. E. Mathot 1906
Modern Power Gas Producers, by Horace Allen 1908
Motor Vehicles for Business Purposes, by A. J. Wallis-Taylor 1905
Nitro-Explosives, by P. Gerald Sanford 1906
Portland Cement, by D. B. Butler 1905
Practical Design of Irrigation Works, The, by W. G. Bligh 1907
Practical Shipbuilding, by A. C. Holmes, vol. 1 and 2 1908
Practical Steam and Hot Water Heating and Ventilating, by Alfred Grant King 1908
Profit-Making in Shop and Factory Management, by Chas. U. Carpenter 1908
Refrigeration, Cold Storage and Ice-Making, by A. J. Wallis-Taylor. 1902
Resistance of Air and the Question of Flying, by A. Samuelson 1905
Steamship Coefficients, Speeds and Powers, by Charles Francis Alexander Fyfe 1908
Steam-Turbine Engineering, by T. Stevens and H. M. Hobart 1906
Theory, Design, Construction and Use of the Modern Steam Engine by John Richardson 1908

Timber, by J. E. Baterden 1908
Tunnel Shields and the Use of Compressed Air in Subaqueous Works by Wm. C. Copperthwaite 1906

REFERENCE BOOKS

Annual Library Index, pub. by N. Y. Publishers Weekly, last volume .. 1908
Atlas of the World's Commerce, by John George Bartholomew 1907
Cyclopedia of the Building Trades, edited by Fred T. Hodgson, vol. 1 to 6 1907
Dictionary of Engineering Terms in English and Spanish, by Andres J. R. V. Garica 1906
Dictionnaire Technique Illustré, in Six Languages, pub. by H. Dunod and et E. Pinat 1908
Greenwood Edgar Classified Guide to Technical and Commercial Books 1904
Handbook on Engineering, by Henry C. Tulley 1907
Poor's Manual of Railroads 1908
Rowell's American Newspaper Directory 1908

MEETINGS OF THE COUNCIL

February 23, 1909

The regular monthly meeting of the Council was held February 23. There were present: President Smith, Messrs. Basford, Bond, Carpenter, Freeman, Humphreys, Hunt, Hutton, Miller, Moultrop, Whyte, Waitt, and the Secretary.

The following deaths were reported: Edwin Reynolds, Past-President; Francis H. Boyer, who was Manager, and Chairman of the Local Committee of the Boston Meeting; R. H. Soule, Charter Member and formerly Manager; Walter M. Allen, George W. Corbin, K. Chickering, William S. Huyette, and Thomas Gray.

The action of the President appointing the following Honorary Vice-Presidents was approved:

To represent the Society at the funeral of Mr. Edwin Reynolds: Messrs. E. T. Adams, F. M. Prescott, E. T. Sederholm, W. J. Sando and James Tribe. To represent the Society at the funeral of Mr. F. H. Boyer; Messrs. G. H. Barrus, F. W. Dean, Gaetano Lanza, G. H. Stoddard and C. J. H. Woodbury.

The resolutions of the Meetings Committee regarding the conduct of The Journal were received and after consideration were referred to the Committee on Advertising in The Journal, consisting of F. R. Hutton, *Chairman*, Geo. M. Basford and the Secretary, for recommendation and report to the Council at its next meeting.

The following resolution from the Meetings Committee was received and referred to a committee of three, to be appointed by the President:

Resolved. That the sanction of the Council be requested to divide the functions of the Meetings Committee relative to the conduct of the annual meetings. That the Meetings Committee shall appoint each year a Chairman who shall select not less than twenty-four assistants, said twenty-five (25) members to constitute a reception committee whose duties shall terminate at the close of the Annual Meeting, that said reception committee shall have sole charge of the collection and distribution of subscriptions for entertainment purposes, and that all entertainment of whatsoever kind, arranged not to conflict with the business and professional sessions, shall be assumed by said reception committee. That the fund so collected shall not in any way conflict with the funds of the Society, and that no expense of any kind relative to entertainment be, as now, a charge against the

cost of conducting the Annual Meeting. That, in case the subscriptions exceed the requirements of the Reception Committee, such excess to be kept in the custody of the Chairman of the Reception Committee; or distributed *pro rata* to the subscribers.

The duties of such committee shall be to consider the general subjects of luncheons, receptions and other entertainments at the annual and semi-annual meetings of the Society; the methods to be followed in arranging for each and the source of funds to cover the necessary expenses of each. This committee will report to the Council at its next meeting.

The following resolutions of the Meetings Committee were adopted as amended:

Resolved. That the Meetings Committee may arrange, subject to the approval of the Council, authorize and discontinue, as in the judgment of the Meetings Committee may be for the best interests of the Society, with members of the Society residing in other places, as is now done monthly in New York, for the presentation and discussion of such papers as may have been previously accepted by the Meetings Committee. The proceedings of such meetings to be reported stenographically, transcribed and sent promptly to the Meetings Committee. The expenses of such meetings to be defrayed by the Society on a basis prearranged with the Meetings Committee; such expenses to be under the control of the Executive Committee of the Council by approval in general, before such expenses are incurred.

Amendment, Rule 2. Upon the recommendation of the President and the Secretary, Rule 2 was amended, eliminating the numbering of badges. As amended and adopted it will read:

R2 The Secretary shall provide a badge or pin for each member or guest attending the annual and semi-annual meetings; the badge of each Member, Associate and Junior to bear his name.

Voted. That the Council authorize the issuance of Professional Records twenty days, instead of thirty days, previous to the issuance of the ballot for the Spring Meeting of 1909.

Conservation Meeting. The Secretary reported the arrangement of the Committee on Conservation of Natural Resources under the auspices of the four national engineering societies for a meeting of the engineering profession to be held on the evening of March 24.

Thurston Memorial. The Chairman of the Thurston Memorial Committee reported the decision of the committee to award to H. A. McNeil the contract for the installation of a bronze replica of the Thurston Memorial, which was installed at Cornell University in June 1908, of which Mr. McNeil was the sculptor. This memorial will be placed in the hallway leading to the rooms of the Society, on the wall opposite the elevators.

Committee on Affiliated Societies. The Committee reported a basis of relation with other societies desiring affiliation with this Society which was approved in principle in the Council and referred to a Special Committee to consist of Messrs. Jesse M. Smith, President, F. R. Hutton and R. C. Carpenter, to perfect details and report to the Council.

It was voted that the Committee on Affiliated Societies be discharged with thanks.

Student Branches. The Secretary reported requests for permission to form student branches which were referred to the Executive Committee for recommendation and report.

The John Fritz Medal Committee. Prof. F. R. Hutton, Honorary Secretary, reported the action of the John Fritz Medal Committee in awarding the medal this year to an Honorary Member of the Society, Mr. Charles T. Porter. A Special Committee, of which Past-President Henry R. Towne is Chairman, and the Honorary Secretary, were appointed to arrange for suitable presentation exercises.

I. E. Moultrop, Member of the Council, asked information respecting the general subject of meetings of members of the Society in Boston. It was the sense of the Council that the holding of meetings by members of the Society in other cities than New York be encouraged and that this communication from Mr. Moultrop be referred to the Meetings Committee for action in accordance with the resolutions that the Committee adopted at this meeting of the Council.

Council adjourned to meet on March 9, at 3.30 p.m.

March 9, 1909

The regular monthly meeting of the Council was held on Tuesday afternoon, March 9, in the rooms of the Society. There were present, Mr. Jesse M. Smith, President, and Messrs. Bond, Carpenter, Gantt, Hunt, Hutton, Miller, Moultrop, Riker, Stott, Waitt, Whyte and the Secretary.

Executive Committee. The action of the Executive Committee in approving the names of candidates for membership in the Society as offered by the Membership Committee was confirmed.

House Committee. The report of the House Committee was approved, recommending the rearrangement of the rooms of the Society, placing the Secretary in the room adjoining the reception room. Upon the recommendation of the Chairman of the Finance Committee the Council approved an appropriation of $50 for the nec-

essary changes in the partitions to effect the above change, and $100 for plates on the pictures, models and historical relics in the possession of the Society.

Library Committee. The Library Committee reported the purchase of new books to the extent of $260.

Special Committees. The special committee appointed under date of February 16, at a meeting of all of the standing committees of the Society with the Executive Committee, to consider the possible relation between the several committees of the Society and the Finance Committee, with respect to the responsibilities of each in the financial administration, recommended a change of the standards of the Society, simplifying the work; the reading of the report was considered as a notice under By-Law 44 leading up to the proposed change, to be voted on at the next meeting of the Council.

Student Branches. The Executive Committee recommended that the Council grant the privilege of Student Branches to the following institutions: Armour Institute of Technology, Chicago, Ill.; Leland Stanford Jr. University, Palo Alto, California; Polytechnic Institute, Brooklyn, N. Y.; State Agricultural College, Corvallis, Oregon; Purdue University, Lafayette, Ind.; University of Kansas, Lawrence, Kan. The Council thereupon approved the recommendation. The Executive Committee offered a set of rules for the guidance of the Secretary in the conduct of this work, and after consideration they were referred back to the committee for further consideration.

Hudson-Fulton Celebration. The President reported on the Hudson-Fulton Celebration the decision of the conferees of the National Engineering Societies, not to hold a loan exhibition, but that instead they were favorably disposed to the installation of a bronze tablet commemorative of Fulton's achievement.

Mr. Stott, Chairman of the Committee on Conservation of the American Institute of Electrical Engineers, announced that there would be a meeting of the Engineering Profession under the auspices of the four National Engineering Societies, on the evening of March 24, on the subject of the Conservation of our Natural Resources.

Voted. That the appropriation of $150 approved by the Finance Committee to cover various expenses already incurred during the year on the subject of conservation, and the additional expenses incident to the participation of the Society in the above meeting, be approved.

Moved by Mr. Miller and seconded by Professor Hutton, that the Committee on Conservation of this Society be instructed to give wide publicity to the meeting of March 24, and after the meeting to give wide publicity to the proceedings of that meeting; it was further

requested that the expenses provided for in this resolution be charged against the meeting.

Voted. That a special appropriation of $100 be made for this purpose, subject to the approval of the Finance Committee.

Involute Gearing. The Secretary read a letter from Mr. P. V. Vernon, member of the Society, Chief Engineer of Alfred Herbert, Ltd., machine tool makers, Coventry, England, to the effect that he proposes that the Institution of Mechanical Engineers and The American Society of Mechanical Engineers coöperate in the matter of a standard for involute gearing.

Voted. To refer the matter to the Committee to be appointed on this subject.

Relations With the Public. Moved by Mr. Miller and seconded by Mr. Gantt, that the President be requested to appoint a committee of three members to prepare and present at the Washington Meeting a report upon the Relation of the Society to the Public. This action to be in accordance with the resolution presented by Mr. Ambrose Swasey and adopted by a vote of the Society at the last annual meeting of the Society, December 1908, which resolution was the result of a paper presented by Mr. Morris L. Cooke on The Engineer and the People.

The following Committee was thereupon appointed by the Council and approved: Messrs. Ambrose Swasey, Morris L. Cooke and the Secretary.

A communication from the United Engineering Societies was received to the effect that the available offices in the building did not exceed one-third of an office floor, and the Society was asked if they had any space which could be given for the use of the sister societies. The Secretary was instructed to respond that the Society had no space unoccupied, and did not desire to release any.

Amendments. By-Laws 27 and 28, also By-Law 17. Notice was given under the requirements of C59 that it is proposed at the next meeting of the Council to vote on amendments to By-Laws 27 and 28 governing the duties of the Library and House Committees, and By-Law 17 to agree with By-Law 14 on requirements and procedure of voting; also of certain changes in the standards in accordance with B44.

American Society of Testing Materials. The request of the American Society of Testing Materials for the appointment of a delegate to an international conference was referred to the Executive Committee with power.

Council adjourned to meeting on April 13, 1909.

NECROLOGY

FRANCIS H. BOYER

Francis H. Boyer died at his home, Somerville, Mass., February 21, 1909. He was born at Manheim, N. Y., in 1845, and at the age of ten years went to Greensburg, Ind., where he remained until he was 18 years old. He learned the trades of millwright, carpenter and architect. On his return to the East he entered the steamboat transportation business in Brooklyn, in which he was engaged during the Civil War.

At the age of 23, he went to the frontier, settling at Seneca, Nemeha Co., Kan., where he carried on a stock and land business for a few years. He then returned to Brooklyn and engaged in the refrigerator building business, and was associated with the building of the first ship refrigerator for carrying beef to Europe. He eventually became superintendent of the De La Vergne & Mixer Co., refrigerator builders, directing the construction of machinery for brewery refrigerators. Mr. Boyer built the first brewery refrigerator in Boston in 1884. His work called him to Washington, Baltimore, Newark and New York. He settled in Boston in 1890, and was appointed master mechanic of the John P. Squire Co. He designed the big chimney at that company's plant in East Cambridge and remained with the company until its assignment in 1900, when he went into business for himself, with his son as a member of the firm.

Mr. Boyer was a Manager of this Society, 1899–1902, and was chairman of the Local Committee at the time of the meeting of the Society in Boston in 1902. He also did important work on the Committee of the Society for Determining Standard Methods for Conducting and Reporting Steam Engine Trials. He was a member of the Boston Society of Civil Engineers; the American Society of Refrigerating Engineers; honorary member of the National Association of Stationary Engineers; Somerville Council, Royal Arcanum. He was President of the Somerville Board of Trade for two years.

GENERAL NOTES

COLUMBIA UNIVERSITY

The Department of Mechanical Engineering of Columbia University, of which Dr. Charles E. Lucke is the head, has developed a feature of the greatest benefit to students by selecting men engaged in active work to give lectures on their specialties. The lectures are based on outlines prepared by the faculty and are a part of the regular work of the engineering students in their third and fourth years.

The course is being conducted by Fred J. Miller, Vice-Pres. Am. Soc. M. E., Elmer Neff, Mem. Am. Soc. M. E., Brown & Sharpe Co., Hugh Aikman, J. H. Williams Co. (Drop Forgings), D. B. Bullard, Machine Tool Co., C. E. Coolidge, Niles-Bement-Pond Co., Geo. Jeppson, Norton Co., Chas. H. Norton, Norton Co. Classifications are as follows:

Elevating and Conveying Machinery, with special reference to economic handling of materials by mechanical means; conducted by Lincoln DeGrott Moss, Consulting Engineer, New York, as representative of seven of the prominent manufacturers of this class of machinery.

Pumping Machinery: lecturers not yet selected except that Mr. Louis Doelling of the Schutte & Koerting Co. will take up jet types.

Air Machinery, including compressors, fans, blowing engines, air lifts, pipe lines and compressed air apparatus, conducted by Mr. Fred W. O'Neil, of the Nordberg Co.

Refrigerating and Ice Making Machinery, by Mr. Fred Ophuls of the De La Vergne Machine Co.

In the fourth year the following courses are conducted with the assistance of outside experts:

Steam Turbines, by Messrs. Callan and Stone and Dr. Loewenstein, all of the General Electric Co.

Manufacturing Plant Design, by Mr. Chas. Day, Dodge & Day Co., Mr. Henry Hess of the Hess-Bright Co., Mr. H. W. Wharton of the Land-Wharton Co., Mr. H. F. Stimson, of the Emerson Co.

Works Management, by Mr. Chas. V. Going, of the *Engineering Magazine,* Mr. C. U. Carpenter, of Herring-Hall-Marvin Safe Co., Mr. R. T. Lingley, Certified Public Accountant, Mr. Harrington Emerson, of The Emerson Co., Mr. J. N. Gunn, of Gunn-Richards & Co.

Water Power Machinery, by Mr. N. M. White of the I. P. Morris Co.

UNIVERSITY OF ILLINOIS

The United States Geological Survey, in coöperation with the State Geological Survey, has established at the College of Engineering, University of Illinois, Urbana, a Mine Explosion and Mine Rescue Station. The purpose of the station is to interest mine operators and inspectors in the economic value of such modern appliances as oxygen helmets and other resuscitation apparatus as adjuncts to the normal equipment of mines. The station also will concern itself with the training of mine bosses and others in the use of such apparatus.

The formal opening of the station constituted a part of the proceedings of a Fuel Conference, held at the University of Illinois, March 11 to 13, under the auspices of the Technologic Branch, U. S. Geological Survey, of the Illinois Geological Survey and of the College of Engineering. On March 11, the rescue station was formally opened with addresses by Pres. E. J. James, University of Illinois; Prof. J. A. Holmes, Mem. Am. Soc. M. E., U. S. Geological Survey; Mr. A. J. Moorshead, Illinois coal operators; Mr. T. L. Lewis, United Mine Workers. There were demonstrations of the use of oxygen helmets and resuscitation work. Addresses were made on the prevention of mine explosions; smoke suppressions and economy in the use of fuels; the fuel resources of the country, etc.

STEVENS INSTITUTE OF TECHNOLOGY

At the annual alumni dinner of Stevens Institute of Technology, held at the Hotel Astor, New York, February 19, President Humphreys, Mem. Am. Soc. M. E., announced that at the next meeting of the Board of Trustees of Stevens Institute, the following new trustees would be elected: Dr. H. S. Pritchett, President of the Carnegie Foundation for the Advancement of Teaching; Mr. John Aspinwall; Dr. D. S. Jacobus, Mem. Am. Soc. M. E.; Mr. Anson W. Burchard. Mem. Am. Soc. M. E.

THE NEW PRESIDENT OF MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Prof. Richard C. Maclauren, formerly professor of the Mathematical Physics, Columbia University, has been called to the presidency of Massachusetts Institute of Technology.

Professor Maclauren was born in Edinburgh, Scotland, in 1870. He entered the University of Cambridge in 1892, graduating with the degree of B.A. in 1895, and receiving the degree of M.A. the following year. In 1898, he received the degree of Sc.D. from the same university and in 1904 the degree of LL.D. In his work for the master's degree he gained the highest possible rank in the most advanced examination in mathematics given at Cambridge, and he received the Smith prize for his thesis on a mathematical subject. After graduation, he was elected a fellow of St. John's College, Cambridge.

He made a study of educational institutions in the United States and Canada and after concluding the investigations he returned to the University of Cambridge and took up the study of law, receiving the McMahon law scholarship. His thesis, The Title to Realty, which was afterward published in English and French, was awarded the Yorke prize. Dr. Maclauren spent several months in study at a German University and in 1898 was appointed Professor of Mathematics at the University of New Zealand. He later became a Trustee of the institution. In. 1903 he was made Dean of the Faculty of Law and resigned this work to accept the appointment to the chair of mathematical physics at Columbia University, in 1907. He has written a book on physical optics, the first volume of which was published in February of last year. He has written a number of papers for scientific magazines; a recent contribution on Higher Technical Education in the United States, which appeared in the *Revue Scientifique* describes the Massachusetts Institute of Technology as the typical American technical school.

THETA XI FRATERNITY

Among those who made addresses at the forty-fifth annual convention of the Theta Xi fraternity in New York, February 19–20, were Onward Bates, President, Am. Soc. C. E., and Samuel Higgins, General Manager, N. Y. N. H. & H. R. R. Wm. H. Wiley, Mem. Am. Soc. M. E., presided at the convention, and Messrs. J. A. Knighton and H. W. Hodge conducted an excursion to inspect the Blackwell's Island Bridge.

RETIREMENT OF PROF. RICHARDS

Prof. C. B. Richards, Professor of Mechanical Engineering, Sheffield Scientific School of Yale University, since 1884, has retired from active service in the University, having reached the age limit of 65 years. Professor Richards' retirement takes effect on the close of the university year at which time he becomes Professor Emeritus.

Prof. Lester Paige Breckenridge, head of the mechanical engineering department of the University of Illinois since 1893, has been appointed Professor of Mechanical Engineering at Sheffield Scientific School, Yale University, to take up his duties in September 1909. Professor Breckenridge was born in Meriden, Conn., May 17, 1858, and was graduated from Sheffield Scientific School 1881. He was instructor in mechanical engineering and was engaged in general engineering work at Lehigh University until 1891. From 1891 to 1893 he was professor of mechanical engineering and director of shops of Michigan Agricultural College at Lansing, Mich.; from 1893 to date, professor of mechanical engineering at the University of Illinois, Urbana, Ill.; and from 1905 to date, director of engineering experiment station, University of Illinois.

Prof. Lionel S. Marks, Mem. Am. Soc. M. E., has been promoted to Professor of Mechanical Engineering at Harvard University. He was educated in King Edward VI School, and Mason College, Birmingham, England, receiving the degree of M.E. in 1891, and the degree of B.S. in 1892 from the University of London, and from Cornell University the degree of M.M.E. in 1894. From the latter date until the present he has been instructor in thermodynamics and assistant professor of mechanical engineering at Harvard, in charge of the engineering laboratories. Professor Marks has also been engaged in consulting and testing work.

STUDENT BRANCHES

The need for establishing student branches of the Society has been shown by the number of applications to form such branches which have been received from technical institutions.

The Council at its meeting March 9 granted permission to form student branches, to the Armour Institute of Technology, Leland Stanford Jr. University, Polytechnic Institute of Brooklyn, State Agricultural College of Oregon, Purdue University, and University of Kansas.

COÖPERATION OF THE AMERICAS

At the Pan-American Scientific Congress, held in Santiago, Chili, in December 1907, the following resolutions were adopted and transmitted to this Society by Dr. L. S. Rowe, Chairman of the Delegation to the Congress from the U. S. and Professor of Political Science at the University of Pennsylvania. We quote in full Dr. Rowe's letter which contained the resolutions.

DELEGATION OF THE UNITED STATES OF AMERICA TO THE PAN-AMERICAN SCIENTIFIC CONGRESS

SANTIAGO, Chile, January 7, 1909.

L. S. Rowe, *Chairman.*

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
CALVIN W. RICE, SEC., 29 W. 39th ST., NEW YORK

DEAR SIR:

At a meeting held during the first week in January, of the Delegates from the United States to the Pan-American Scientific Congress, the following resolution was adopted:

"RESOLVED, That this Delegation officially bring to the attention of the learned societies of National scope in the United States the desirability of inviting the scholars and investigators of Latin-America to coöperate with them."

In accordance with this resolution it is my duty to assist you to lay the matter before The American Society of Mechanical Engineers for consideration.

In the opinion of the Delegation the inviting of the scholars and investigators of Latin-America to participate in the annual meetings of your Society would greatly tend to promote mutual friendship between North and South America. It has often been difficult in the past to secure intercommunication between scientists in the two Americas who are interested in similar subjects. It is felt that if it were possible to secure the attendance at your meetings of representatives from Latin-America, or to obtain papers from them, to be read in the appropriate sections of your annual meetings, an important step forward would be made toward enlarging the opportunity for North American specialists to exchange ideas with those of South America. Although the objects of the suggested coöperation may be achieved in a greater or lesser degree by means of the triennial Pan-American Scientific Congresses (the next of which is to meet in Washington in October 1912) our experiences in Santiago have led us to believe that the plan suggested herewith will prove to be of great practical value.

If your association decides to invite the coöperation of the scholars and investigators of Latin-America, the chairman of the delegation will be very glad to be of any possible assistance, or to endeavor to obtain the names of such Latin-American scientists as might most acceptably serve the purposes of your association.

Yours very truly,
(Signed) L. S. Rowe, *Chairman.*

The Congress mentioned was the first Pan-American and was held under the auspices of the government of Chili. Questions of interest to South, Central and North America were discussed, and universities, scientific societies, South American and foreign corporations were represented.

NORTH AMERICAN CONSERVATION CONFERENCE

The North American Conservation Conference, which was held in Washington, February 18, 1909, has published a Declaration of Principles in regard to forests, lands, minerals and the protection of game.

The Conference agrees that the conservation movement tends strongly to develop national efficiency in the highest possible degree; that to accomplish such an object with success, the maintenance and improvement of public health is the first essential, and that in all steps for the utilization of natural resources considerations of public health should be kept in view.

The Conference recognizes that the forests are indispensable to civilization and public welfare, and regards their wise use, effective protection and renewal, as a public duty, devolving upon all forest owners, public, corporate or individual.

The land they declare to be a fundamental resource, yielding the materials needed for sustaining population and forming the basis of social organization. The special need is to promote productivity. They favor the possessing of the land by the men who live upon it, not only as promoting such productivity, but also as the best guarantee of good citizenship.

The mineral resources are recognized as forming the chief basis of industrial progress and as playing an indispensable part in our modern civilization. Their use and conservation are regarded as essential to the public welfare. The Conference favors action by each government looking towards reduction of the enormous waste in the exploitation of such fuels, and directs attention to the necessity of an inventory of this resource.

The preservation of game and the protection of bird life, they declare to be intimately associated with the conservation of natural resources, and favor game protection under regulation, the creation of extensive game preserves, and the special protection of such birds as are useful to agriculture.

They regard the action of the President of the United States, in calling a conference to consider the conservation of the natural

resources of North America, as in the highest degree opportune, and believe the proceedings of the conference and the information mutually communicated by the representatives assembled to have been conducive to the best interests of the countries participating. They recommend the establishment in each country of a permanent Conservation Commission, and through these several commissions a system of intercommunication whereby all discoveries, inventions, processes, inventories of natural resources, seeds, seedlings, new or improved varieties, and other material of value in conserving or improving a natural resource, shall be transmitted by each Commission to all of the others.

The Commissioners representing the United States, the Dominion of Canada, the Republic of Mexico and the Colonies of Newfoundland, signed a statement on February 23, 1909, addressed to the President of the United States, and expressing their belief that the Conservation of Natural Resources is a problem world-wide in scope, and that therefore all nations should be invited to join in a conference on the subject of world resources, their inventory, conservation and wise utilization.

The Conference was attended by Professor Swain, Chairman of the Committee of this Society on the Conservation of Natural Resources.

THE NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION

The National Society for the Promotion of Industrial Education, of which Dr. Alex. C. Humphreys, President of Stevens Institute of Technology, and Mem. Am. Soc. M. E., is president, has issued a letter inviting interest in its membership and giving a brief summary of its purpose and the work accomplished. An extract states:

> The organization exists to further in every way the movement to better industrial training and its members are in every State in the union. It represents no special class; its meetings and publications form an open forum wherein the opinions of all parties may be frankly expressed.
>
> The very serious need for industrial education is evident in many quarters. Knowledge of the movement is equally important to employers, employees and school officers. By identifying yourself with the national society, you will aid in the work which the society represents, you will be in touch with its continued development, and you will secure important contributions to the literature of industrial education.

THE LOUISIANA ENGINEERING LAW

The Louisiana State Legislature has passed a bill to regulate the practice of Civil Engineering and Surveying in Louisiana, and appointed a Legislative Committee to guard its interests.

The bill originated in the Louisiana Engineering Society, and provides for the regulation and the practice of Civil Engineering and Surveying; creates a State Board of Engineering Examiners, and regulates their fees and emoluments The purpose of the law is to prevent the practice of the civil engineering or surveying by unauthorized persons; and to provide for the trial and punishment of violations of the law by fine or imprisonment.

The law provides that no person except those already engaged in this practice of civil engineering under the existing engineering and surveying laws of the State shall practice the profession unless such person possesses all the requirements of the law.

After the passage of the act, any person entering upon the practice of civil engineering or surveying shall present to the Board of Engineering Examiners a diploma from an engineering school of good standing, or pass a satisfactory examination. For Surveying: Geometry, Trigonometry, Land Surveying, Practical Use of Instruments. Civil Engineering: the same as surveying with the addition of Natural Philosophy or Physics.

The applicant must be at least twenty-one years of age, of good moral character, and possess at least a primary education.

The Board of Engineering Examiners is to consist of five members; all must be practicing civil engineers or surveyors. The Board shall be appointed by the Governor of the State from a list presented by the Louisiana Engineering Society.

OTHER SOCIETIES

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The American Institute of Electrical Engineers celebrated on March 11 the twenty-fifth anniversary of their organization. The celebration took the form of a dinner at the Hotel Astor.

The decorations were a remarkable exhibition of electrical display, the plants and flowers being illuminated from below through cut crystal. The Rialto, the Grand Canal, and the Cathedral Campanile of St. Mark were reproduced, the Cooper-Hewitt light affording an illumination which made the scene remarkably realistic.

Messages were read from Alexander Graham Bell, inventor of the telephone; from Thomas A. Edison, inventor of the incandescent lamp; from the Institution of Electrical Engineers, London; La Société Internationale des Electriciens, Paris, and Der Verband Deutscher Elektrotechniker, Berlin.

Three hundred and fifty members and guests were present. Louis A. Ferguson of Chicago, President of the Institute, was toast master; Jesse M. Smith, President of Am. Soc. M. E., gave an address of greeting from the sister societies; and other addresses were made by Elihu Thomson and Frank J. Sprague, past-presidents of the Am. Inst. E. E., and by Dr. Alex. C. Humphreys, President of Stevens Institute of Technology.

At the meeting of the American Institute of Electrical Engineers, March 12, the secretary announced that 113 associates had been elected and 5 associates transferred to the grade of member. The following list of nominees was made by the board of directors for officers to be elected this spring; President, Lewis B. Stillwell; Vice-presidents, John J. Carty, Paul M. Lincoln, Paul Spencer; Managers, A. W. Berresford, W. S. Murray, H. H. Norris, S. D. Sprong; Treasurer, George A. Hamilton; Secretary, Ralph W. Pope.

Barton R. Shover, Electrical Engineer of the Indiana Steel Company of Gary, Ind., presented a paper entitled The Industrial Application of the Electric Motor, as illustrated in the Gary Plant of the Indiana Steel Company. The paper was illustrated with lantern

slides and was discussed by Messrs. B. A. Behrend, Gano Dunn, D. B. Rushmore, W. T. Dean, Robert Hull, Brent Wiley, L. A. Ferguson, and B. R. Shover.

The American Institute of Electrical Engineers cordially invite the members of this Society to attend the meetings of the Institute wherever held. The invitation covers the branches of the Institute which hold frequent meetings at different points in the country. This is an opportunity, afforded to members of the Society in New York and elsewhere, which they will doubtless find offers much of pleasure and profit, and it is hoped that the members will avail themselves of this kindness on the part of the A. I. E. E.

AMERICAN ELECTROCHEMICAL SOCIETY

The annual meeting of the American Electrochemical Society is to be held at Niagara Falls on May 6, 7 and 8. Papers will be presented by Gustave Gin of Paris and by Dr. Kjellin, the inventor of the Kjellin furnace. A paper on the Héroult steel furnace is expected from Mr. Robert Turnbull.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At a meeting held on March 3, two papers were presented for discussion. They were, The Action of Frost on Cement and Cement Mortar, together with other Experiments on these Materials, by Messrs. Ernest R. Matthews and James Watson, and The Bonding of New to Old Concrete, by Mr. E. P. Goodrich.

AMERICAN SOCIETY OF HUNGARIAN ENGINEERS AND ARCHITECTS

A number of Hungarian Engineers and Architects pursuing their professions in this country have organized the American Society of Hungarian Engineers and Architects. The society has two objects: first, to bring in closer touch engineers and architects of Hungarian extraction, living in this country, and to give moral support and information to newcomers; second, to encourage the exchange of engineering, technical and industrial information between the technical men of Hungary and of the United States and to foster technical societies, sciences and industries.

The society will hold monthly meetings when papers will be read and discussed. The membership consists of mechanical, electrical

and civil engineers, chemists, architects and craftsmen. The officers of the new society are as follows: President, A. Henry Pikler; Vice-President, Karoly Z. Horvay; Secretary, Zoltan de Németh; Treasurer Sandor Oesterreicher; Assistant Secretary, Ernest L. Mandel. The society's business address is Box 1031, New York.

WASHINGTON SOCIETY OF ENGINEERS

At the meeting of the Washington Society of Engineers, February 16, Mr. Van H. Manning, topographer of the U. S. Geological Survey, gave an illustrated lecture on the overflow lands in the Yazoo Delta, which outlined the preliminary investigations now being made by the U. S. Geological Survey in coöperation with the State of Mississippi, leading to the reclamation of 7000 square miles extending south along the Mississippi River from a point ten miles south of Memphis.

Following this lecture, the society gave an informal reception to the engineers, who accompanied President-elect Taft to Panama: Frederic P. Stearns; John R. Freeman, Mem. Am. Soc. M. E.; Isham Randolph; Capt. Charles P. Allen; Allen Hazen; James D. Schuyler; Arthur P. Davis. Other guests were W. H. Code, Chief Engineer, Indian Reclamation; L. C. Hill, Supervising Engineer, U. S. Reclamation Service; Marsden Manson, City Engineer, San Francisco; C. E. Grunsky, Consulting Engineer, New York; W. B. Matthews, Chief Counsel, Los Angeles Aqueduct Commission.

BOSTON SOCIETY OF CIVIL ENGINEERS

The Boston Society of Civil Engineers had its regular monthly meeting on February 17.

A paper presented by Mr. H. M. Haven, Refrigerating Engineer with Mr. F. W. Dean, Mem. Am. Soc. M. E., reviewed briefly the general theory of refrigeration and the various types of refrigerating apparatus using ammonia as a refrigerant.

The many modern applications of refrigeration were taken up in some detail, including plate and can ice-making, the preservation of food in refrigerated warehouses, pipe-line refrigeration, fish freezing, packing-house refrigeration, storage of furs and fabrics, tunneling, hospital and auditorium cooling, the cooling of chocolate factories, the use of chilled air in the transportation of fruit, and refrigeration as applied to the air supply of blast furnaces.

The paper was fully illustrated by lantern slides.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS

The New England Association of Gas Engineers held their annual meeting on February 17 and 18, at Young's Hotel, Boston, Mass.

The following papers and topics were discussed: Street Lighting, Edwin Garsia; Tar for Roads, Charles P. Price; A Comparison of the Enriching Values of Benzol and Gas Oil, L. J. Willien; Some Results of the Use of Steam and Air Meters in the Water Gas Plant, R. E. Wyant; The Comparative Practical Efficiency of Various Types of Gas Lamps, R. C. Ware; Why the Gas Man should be an Illuminating Engineer, Norman Macbeth; Calorimetry, J. B. Klumpp.

All the officers were reëlected for the coming year, as follows: President, W. G. Africa; Vice-Presidents, W. H. Snow, B. J. Allen; Directors, D. D. Barnum, Thomas H. Hintze, C. A. Learned, J. A. Coffin, H. K. Morrison; Secretary and Treasurer, Nathaniel W. Gifford.

NEW YORK RAILROAD CLUB

The meeting of the New York Railroad Club of February 19 was occupied chiefly with a paper by Col. B. W. Dunn, on The American Railway Association's Bureau for the Safe Transportation of Explosives and Other Dangerous Articles. This paper was discussed by W. G. Besler, H. F. Allen, N. D. Maher, and Dr. C. B. Dudley, Mem. Am. Soc. M. E.

A Committee appointed at a previous meeting reported a testimonial to Mr. Herbert H. Vreeland, Past-President of the club, which is to be engrossed and framed, and presented to Mr. Vreeland in recognition of the long and valuable service he rendered the club as its chief executive.

TECHNICAL SOCIETY OF BROOKLYN

In the regular bi-monthly meeting of the Technical Society of Brooklyn, on February 19, Mr. F. F. Grevatt read a paper on Electrical Power Transmission, written by Mr. Henry Pikler. A general discussion elicited some interesting information on practical results in connection with the more theoretical features of the lecture.

Following up this subject, J. P. Freund, in the society's meeting on March 5, lectured on Demonstrations and Effects of Electricity, with special reference to wireless telegraphy. The paper was discussed by Mr. Wm. Kajerdt and Dr. Adolph Maeusert.

ENGINEERING SOCIETY OF WISCONSIN

The organization of the Engineering Society of Wisconsin was completed at the first meeting held at the University of Wisconsin, February 24–26. The officers elected were: President, Dean F. E. Turneaure, University of Wisconsin, College of Engineering; Vice-President, McClelland Dodge; trustees for two years, B. F. Lyons and E. P. Worden; trustees for one year, E. Gonzenbach and E. R. Banks.

PROVIDENCE ASSOCIATION OF MECHANICAL ENGINEERS

On Wednesday evening, February 24, 1909, at the Technical School Hall, Providence, R. I., Mr. Walter Massie of the Massie Wireless Telegraph Co., delivered a lecture on the subject of wireless telegraphy. He gave a brief history of the discovery and improvement of wireless telegraphy, thoroughly explaining the important events since 1888. The lecture was illustrated by sketches on the blackboard and by working apparatus. A transmitting receiving system was set up on the stage and the process of sending and receiving messages was explained and demonstrated.

ROCHESTER ENGINEERING SOCIETY

The regular monthly meeting of the Rochester Engineering Society which was to be held on February 12 was postponed until February 26. At this meeting, Mr. Stephen P. Cobb presented a paper on The Artificial Gas Industry of the Present Day, which was illustrated by lantern slides.

WESTERN SOCIETY OF ENGINEERS

At the March 3 meeting of the Western Society of Engineers, Mr. John M. Ewen presented a paper on the subject, The Chicago Harbor and River.

BLUE ROOM ENGINEERING SOCIETY

The subject under discussion at the March 4 meeting of the Blue Room Engineering Society was The Mechanical Equipment of the Singer Building, by Mr. Charles G. Armstrong. During the course of the lecture, which was illustrated with lantern slides, Mr. Armstrong described the design and construction from the sinking of the first caisson to the unfurling of the flag at the peak of the pole.

COLORADO SCIENTIFIC SOCIETY

At the March 6 meeting of the Colorado Scientific Society, Mr. Victor G. Hills read a paper on Tungsten, showing a map of the Boulder County fields. This was followed by a paper by Mr. Henry E. Wood entitled Notes on Magnetic Separation as Applied to Tungsten Ores.

NEW ENGLAND WATER WORKS ASSOCIATION

At the meeting of the New England Water Works Association held at the Hotel Brunswick, Boston, Mass., March 10, an address on Civil Service in its Application to the Water Department, was given by Hon. Joseph C. Pelletier of the Massachusetts State Civil Service Commission. This was followed by a description of work in progress for the New York Board of Water Supply, and Mr. J. Waldo Smith, Mem. Am. Soc. M. E., Chief Engineer of the Board, and Mr. Carroll F. Story, presented a paper on The Ludlow Filters.

FRANKLIN INSTITUTE

The meeting of the Franklin Institute, March 11, was devoted to a lecture by Dr. A. S. McAllister of New York on Power Factor and Commutation Conditions in Single Phase Series Motors, showing how the difficulties heretofore existing in this type of motor have been practically overcome.

OHIO ELECTRIC LIGHT ASSOCIATION

The Ohio Electric Light Association will hold its annual convention in Toledo, Ohio, July 13–15. The program will include the following topics: The Titanium Arc Lamp, Reports and Discussion on Tungsten Lamp Experience; The Supply of Current for Lighting, to other Towns from a Centrally Located Station; Report on Methods of Lamp Renewals; Commercial Organization of an Electric Light Company and its Relation to the Public; Factors Determining the Prices to be Charged for Street Lighting.

INDUSTRIAL EXPOSITION AT CLEVELAND, OHIO

Cleveland's Industrial Exposition will be held June 7 to 19, in Central Hall. A temporary exposition building has been erected diagonally across the street; the area of the two halls will be 14,655 sq. ft. The exhibits include the latest types of street cars and range from ponderous machinery to the intricate products of expert workmanship.

CLEVELAND ENGINEERING SOCIETY.

At the regular meeting of the Cleveland Engineering Society, March 9, 1909, Mr. George R. Shepard read a paper on Some Engineering Problems in Connection with the Niagara Power Development. Among the discussors of this paper were Messrs. Roberts, Mordecai, McKinnon.

PERSONALS

Mr. W. L. Abbott has been reëlected president of the board of trustees of the University of Illinois.

Mr. L. P. Alford has contributed an article on An Analysis of 5500 Machine-shop Accidents, to the February 11 issue of *The American Machinist.*

Mr. George M. Basford has contributed an article on Railway Business Association—an Inside View, to the February 6 issue of *The Railway and Engineering Review.*

An extract of The Application of Low-Pressure Turbines to Power Generation, by Mr. James R. Bibbins, read before the Canadian Society of Civil Engineers, Montreal, Que., was published in the March first number of *The Practical Engineer.*

Mr. Sterling H. Bunnell has contributed an article on The Problem of the Small Refrigerating Machine to the March issue of *Cassier's Magazine.*

Mr. A. G. Christie has issued a book on The Steam Turbine.

Mr. Frank M. Coffin has entered the employ of the Maintenance Co., New York, in the capacity of Superintendent of Construction and Repairs. He was until recently in the construction department of the Otis Elevator Co., New York.

The Status of the American Motor Car, by Mr. Howard E. Coffin, appeared in the February issue of *The Gas Engine.*

Mr. William C. Coffin, until recently president of the Coffin McKean Co., Pittsburg, Pa., has become connected with the Jones & Laughlin Steel Co., Pittsburg, Pa., in the capacity of Structural Engineer.

Mr. Charles Day has given a series of lectures on Designs for Manufacturing Plants, under the direction of the mechanical engineering department of Columbia University.

Mr. Henry L. Doherty has contributed an article on the benefit of Exhibits and their Effect on Commercialism to the March first issue of *Progressive Age.*

Mr. Geo. W. Dunham has resigned as Chief Engineer of the Olds Motor Works to accept a similar position with the Hudson Motor Car Co. of Detroit.

Mr. Charles E. Eaton, of the firm of Eaton & Brownell, Watertown, N. Y., has prepared the plans and specifications for the largest talc mill in the world, near Hailesboro, N Y. This was erected for the International Pulp Company.

Mr. H. P. Fairfield has an article, A Planer with Elaborate Ornamentation in the March issue of *Machinery.*

Mr. Walter Ferrier, Assistant to General Superintendent, Carnegie Steel Co., has been transferred to the Schoen Steel Wheel Plant, McKees Rocks, Pa.

Mr. H. D. Fisher is no longer connected with Arthur D. Little of Boston, Mass. He has entered the employ of the U. S. Glass Co., of Pittsburg, as Supervising Engineer.

Mr. Floyd W. Frederick has accepted a position on the engineering staff of the National Board of Fire Underwriters as Mechanical Engineer. Until recently he was associated with the Stroudsburg Engine Works, as Superintendent and Mechanical Engineer.

Mr. Lawford H. Fry has contributed an article on The Advantages of the Use of Moderately Superheated Steam in Locomotive Practice, to the March 5 number of *The Railroad Age Gazette.*

Mr. Hugo Fuchs has severed his connection with the New York Central and Hudson River R. R. Co., and is now engaged as Consulting Engineer in Budapest, Hungary.

The fourth edition of Mr. William P. Gerhard's book, Guide to Sanitary Inspection, has been issued, entirely revised and enlarged.

Mr. W. W. Gore, formerly with the Fairbanks Morse Mfg. Co., Beloit, Wis., in the capacity of Experimental Engineer, has become Vice-President of the Gas Power Manufacturing Co., with office in Seattle, Washington.

Comparative Tests of Run-of-Mine and Briquetted Coal on Locomotives, by Prof. W. F. M. Goss, extracts from Bulletin 363 of the United States Geological Survey, was published in the February issue of *The American Engineer and Railroad Journal.*

An abstract of Mr. J. C. Wm. Greth's paper, Impurities Causing Scale and Corrosion, which he read before the American Institute of Chemical Engineers, appeared in the March 2 number of *Power and the Engineer.*

Mr. George T. Gwilliam has become Resident Manager of The Hess-Bright Mfg. Co., 1974 Broadway, New York.

The March 18 issue of *The Automobile* contains an article, Automobile Cooling Systems Analyzed, by Mr. Morris A. Hall.

Mr. Adalbert Harding, formerly employed by the Westinghouse Machine Co., is now representing the Wickes Boiler Co., in the eastern territory, with an office in the West Street Bldg., New York.

Mr. Louis G. Henes, formerly Manager of the machine tool department of Harron, Rickard & McCone, has opened offices in the Monadnock Building, San

Francisco, Cal. He will carry on a railway, industrial and contractors' equipment business.

Mr. Herbert T. Herr, formerly of Denver, Colo., has accepted a position as General Manager of the Westinghouse Machine Co., East Pittsburg, Pa.

Mr. Reuben Hill, until recently associated with Tiffany Studios Factory, Corona, L. I., N. Y., has become Factory Manager of The Bristol Engineering Corporation, Bristol, Conn.

Mr. Arthur H. Hutchinson has accepted a position with the C. W. Keltning Mercantile Co., Denver, Colo.

Prof. F. R. Hutton delivered a lecture on Large Gas Engines at a meeting of the Mechanical Engineering Society of Columbia University, February 18.

Mr. R. B. Jackson, formerly Factory Manager of the Olds Motor Works, and more recently General Manager of the E. R. Thomas Motor Co., Buffalo, N. Y., is now General Manager and Treasurer of the Hudson Motor Car Co. of Detroit.

Mr. Washington Jones has been elected an honorary member of the Engineers' Club of Philadelphia, of which he has long been an active member.

Mr. Robert Thurston Kent has resigned as Engineering Editor of the Iron Trade Review, Cleveland, O., to become Managing Editor of *Industrial Engineering*, Pittsburg, Pa., a new paper devoted to mechanical engineering subjects. Mr. Kent has been with *The Iron Trade Review* since 1905, and prior to that time was Associate Editor of *The Electrical Review*, New York.

In the March 2 number of *Power and the Engineer* was published an article on Removal of Oil and Grease from Boiler Feed Water, by Mr. Arthur E. Krause.

Mr. R. K. LeBlond sailed, Feb. 11, for an extended trip to the Mediterranean.

Mr. John E. Lord has accepted a position with the Sight Feed Oil Pump Co. in the capacity of Assistant Manager.

Mr. William H. McKiever, recently associated with the Wells & Newton Co., New York, has opened an office at the Everett Bldg., and will conduct a general engineering and contracting business.

The February issue of *Cassier's Magazine* contains a biographical sketch by William L. Cathcart, Charles H. Manning, Chief Engineer, U. S. N., Retired.

Mr. Harry J. Marks, formerly with the Empire State Engineering Co., is now associated with Mr. Edward P. Hampson, 170 Broadway, in a general engineering business.

An illustrated article on Dynamometer Car of the University of Illinois and the Illinois Central Railroad, by Mr. F. W. Marquis, appeared in the February 19 issue of the *Railroad Age Gazette*.

Mr. Daniel W. Mead is the author of a book on Water Power Engineering.

Col. E. D. Meier, an authority on smoke abatement, addressed the Milwaukee Public City Club on the evening of February 3.

Mr. Arthur E. Michel has opened an office in the Hudson Terminal Building, 50 Church St., New York, as Advertising Engineer. He was recently Manager of the George H. Gibson Co., New York.

Mr. Fred J. Miller, Vice-President of the Society, became connected March 1, with the Union Typewriter Co., New York, as Assistant to the President.

Mr. Harvey E. Molé and Mr. Charles O. Lenz have opened offices at 71 Broadway, New York, under the firm name of Lenz & Molé, and will carry on a general engineering business.

Mr. Stanley H. Moore has issued a book called Mechanical Engineering and Machine Shop Practice.

Mr. E. R. Morrison has published a book called, Morrison's Spring Tables.

Mr. A. F. Murray has accepted a position with the Geo. F. Blake Mfg. Co., East Cambridge, Mass. He was until recently connected with Elliott-Fisher Co., Harrisburg, Pa.

Mr. Geo. R. Murray has been appointed President of The Maxwell Rolf Stone Co., Cleveland, O. He was formerly connected with the Ingersoll-Rand Co., New York, as General Manager of Sales.

Mr. F. H. Neely, until recently in the employ of the Westinghouse Electric and Manufacturing Co., has opened offices for industrial engineering, in Atlanta, Ga.

Prof. R. B. Owens has retired on account of ill-health from McGill University, where he was Professor of Electrical Engineering.

Mr. Cortlandt E. Palmer has tendered his resignation as vice-president, director and consulting engineer of the Esperanza Mining Co. to take effect on April 1, terminating six years of continuous connection with the property in charge of operations.

An article by Mr. E. N. Percy on Large Gas Engines for Ships was published in the January 30 issue of *Scientific American Supplement.*

Mr. George W. Rink has succeeded Mr. B. P. Flory as Mechanical Engineer of the New Jersey Central Railroad. Mr. Rink was formerly Chief Draftsman M. P. Dept., of this railroad.

Mr. William F. Rust, who was until recently connected with the American Sheet and Tin Plate Co., Pittsburg, Pa., as Assistant Engineer, has accepted a position with the Youngstown Sheet and Tube Co., Youngstown, O.

Mr. James E. Sague has been nominated by Governor Hughes, Public Service Commissioner in the Second District, to succeed himself, for a term of five years.

Mr. William L. Saunders, President of the Ingersoll-Rand Co., has been appointed a member of a special committee of the Chamber of Commerce of the State of New York to prepare a report on the Panama Canal. The Committee will probably review the findings of several engineers on the question of the merits of a sea level canal as against a lock canal, and investigate the advantages of the canal to American commerce, and will likely report on the question of the benefits to be derived from the canal in the future.

Mr. William E. Smith has resigned his position with the American Locomotive Co., and accepted a position in the Mechanical Engineering Department of the Lackawanna Railroad, Scranton, Pa.

Mr. W. B. Snow is the author of The New Power Plant of the Somerset Coal Co., published in the March 1 number of *The Practical Engineer*. Mr. Snow has recently been elected a member of the corporation of the Massachusetts Institute of Technology.

Mr. O. C. Spurling has become Plant Engineer of the Western Electric Company, Hawthorne, Ill. He was formerly Assistant Plant Engineer, also Factory Engineer, of the same company.

Dr. Charles P. Steinmetz is the author of General Lectures on Electrical Engineering.

Mr. Chas. A. Straw has become Mechanical Superintendent of The Lehigh Coal and Navigation Co., Lansford, Pa. He was formerly associated with the Lehigh Valley Coal Co., Wilkes-Barre, Pa., as Mechanical Engineer.

Mr. Robert Barnard Talcott was appointed by executive order, Assistant Chief Mechanical and Electrical Engineer, office of Supervising Architect, Treasury Department, Washington, D. C. He was until recently General Manager of the Vacuum Cleaner Co., New York.

Dr. Fred. W. Taylor gave an address before the College of Engineering of the University of Illinois, Thursday, February 18, along general engineering lines supplemented by anecdotes from the early part of the careers of successful engineers. On February 16, Dr. Taylor was entertained by a group of local manufacturers in Cincinnati, O. During the evening he gave an address on technical subjects.

Mr. Henry R. Towne, President of the Yale & Towne Mfg. Co., was unanimously reëlected President of the Merchants' Association of New York, February 25, 1909.

Mr. A. F. Van Deinse, who was Sales Manager, Chas. C. Moore & Co., Los Angeles, Cal., is now associated with the El Tiro Copper Co., El Tiro, Pima Co., Arizona.

The Hammer Blow from Incorrect Counterbalance, by Mr. H. H. Vaughan, appeared in the February issue of the *American Engineer and Railroad Journal.*

The Board of Water Supply of New York has announced the appointment of Mr. Arthur West as Expert Mechanical Engineer.

The March 9 issue of *Power and the Engineer* contains Safety Valves, by Mr. Frederic M. Whyte, together with some of the discussion presented at the February 23 meeting of the Society.

Mr. H. V. Wille's paper on A New Departure in Flexible Staybolts appeared in the February 13 issue of *The Railway and Engineering Review*.

MEMORIAL

GUSTAVE CANET

Honorary Member, Am. Soc. M. E.

Gustave Canet was born at Belfort, France, on September 29, 1846. He was educated at the University of Strasburg and the École Centrale des Arts et Manufactures, at Paris. He first gave attention to railway construction, and was attached to the railway works at Reichshoffen, Alsace. In August 1870, the Franco-German war having broken out, he was gazetted Lieutenant of Artillery in the Gardes Mobiles du Haut-Rhin and ordered to Neuf-Brisach with his regiment. He was present at the siege of that town, and took an active part in the construction of its lines of defense, being afterwards made a prisoner of war by the Prussian Army and sent to Leipzig. At the close of the war, and after his liberation, he resumed railway engineering work and found active employment in the construction of the Delle-Porrentruy Railway, Switzerland.

All matters relating to artillery and fortifications had always evoked in him the keenest interest, and in 1872 he severed his connection with the Swiss railway above referred to, and took an appointment with the London Ordnance Works Company, the property of M. Vavasseur, the eminent British specialist in gun construction, who at that time was established in Southwark. As early as 1876 M. Canet propounded the theory of hydraulic brakes for checking the recoil of guns, and put forward new principles for the construction of gun carriages and mountings, thus originating a new era in the manufacture of ordnance.

He left this company in 1881 and put in an ordnance department at the works of the Société Anonyme des Forges et Chantiers de la Méditerranée, at Havre, where he remained until 1897. During that period the ordnance department of the French company in question built the armament for the foreign men-of-war designed and constructed at the shipyards of the firm located on the Mediterranean and on the Atlantic. Progress in this respect was marked, especially following upon the bill passed in the French Parliament in 1885, authorizing the free manufacture in France of war material destined

for foreign governments. This led to an extension of the Havre Ordnance Works, and the construction of all types of guns, in addition to naval ordnance, was gradually taken in hand.

In 1897 the Schneider Works at Creusot was amalgamated with the Havre Works, and from 1897 to 1907 the whole was placed under the directorship of M. Canet. Vast sums were expended in developing ordnance factories and proving-grounds at both places, and a long-range proving ground was added at Tancarville.

M. Canet retired from active business at the commencement of 1907, but remained the technical adviser of the Schneider Company in matters concerning armament. At the time of his death, therefore, he had served French industry for a period of over twenty-six years.

It will be remembered that after the disastrous explosion on board the French battleship Jena, the expert knowledge of M. Canet was again called into requisition by the French Government, and he was appointed a member of a committee formed to investigate the whole question of explosives.

M. Canet was Past-President of the Société des Ingenieurs Civils de France, of the Association Amicale des Anciens Elèves de l'École Centrale, and of the Association Française pour la Protection de la Propriété Industrielle, of which he was elected Honorary President. He was, further, Honorary President of the Chambre Syndicale des Fabricants et Constructeurs de Matèriel de Guerre; Honorary Member of the Imperial Technical Society of Russia; of the Iron and Steel Institute; President of the Junior Institution of Engineers; Member of the Institution of Civil Engineers and of the Institution of Naval Architects, England; Life Member of the Imperial Institute, England; of the Naval Institute of the United States of America; and of the French Société d'Encouragement pour l'Industrie Nationale; and Life Member, Member, or Founder, of numerous other French societies and institutions. He was also Commander of the Legion of Honor, and Officier de l'Académie, and held besides fifteen high decorations from foreign countries for services rendered them in regard to their rearmament.

M. Canet died October 7, 1908, at his seaside home, St. Aubin sur Mer, in Calvados, where since his retirement from active business he had spent a great part of his time.

THE JOURNAL

OF

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

VOL. 31 MAY 1909 NUMBER 5

WASHINGTON MEETING

PROGRAM

Tuesday, May 4

8.15 p.m.

Reception of the members by the Washington Society of Engineers, at the New Willard Hotel. Music by the Marine Band.

Address of welcome by Hon. Henry B. F. Macfarland, President of the Board of District Commissioners.

Response by Mr. Jesse M. Smith, President of the Society.

Wednesday, May 5

PROFESSIONAL SESSION, 9.15 A. M.

Business Meeting. Reports of Committees, Tellers of Election, New Business.

A UNIQUE BELT CONVEYER, Ellis C. Soper.

AUTOMATIC FEEDERS FOR HANDLING MATERIAL IN BULK, C. Kemble Baldwin.

A NEW TRANSMISSION DYNAMOMETER[1], Prof. Wm. H. Kenerson.

POLISHING METALS FOR EXAMINATION WITH THE MICROSCOPE,[1] Albert Kingsbury.

Sight-seeing automobile trips about the city at 10 a.m. for the ladies.

[1] To be presented by title or in brief abstract.

WEDNESDAY AFTERNOON

Special exhibition drill by troops at Fort Myer, 2.30 p.m.

Take special cars in front of the New Willard Hotel at 1 p.m. for the trip to Fort Myer.

Trips to nearby points of interest at 4 p.m.

WEDNESDAY, 8.15 P.M.

Illustrated lecture by F. H. Newell, Director of the Reclamation Service, on "Home-Making in the Arid Regions."

Ladies are specially invited.

Thursday, May 6

THE GAS POWER SECTION 9.15 A. M.

Report of the Standardization Committee.

MARINE PRODUCER GAS POWER, C. L. Straub.

OPERATION OF A SMALL PRODUCER GAS POWER PLANT, C. W. Obert.

A METHOD OF IMPROVING THE EFFICIENCY OF GAS ENGINES, Thos. E. Butterfield.

OFFSETTING CYLINDERS IN SINGLE-ACTING ENGINES, Prof. T. M. Phetteplace.

Trips for the ladies to points of interest in and about the city at 10 a.m.

THURSDAY, 2.30 P.M.

Reception of members and guests by President Taft in the East Room of the White House.

THURSDAY, 8.15 P.M.

Address, "The Engineer in the Navy," by Rear-Admiral Geo. W. Melville, Retired.

Address, "Rear-Admiral Melville's Service to the Engineering Profession and to the Nation," and presentation to the historical series of paintings in the National Museum of a portrait of Rear-Admiral Melville; by Walter M. McFarland of Pittsburg, Pa. Acceptance of the portrait by Dr. C. D. Walcott, representing the Nation.

Ladies are specially invited.

Friday, May 7

PROFESSIONAL SESSION, 9.15 A. M.

SMALL STEAM TURBINES, Geo. A. Orrok.

OIL WELL TESTS, Edmund M. Ivens.

Safety Valve Discussion, Continued from the February meeting in New York.

Specific Volume of Saturated Steam,[1] Prof. C. H. Peabody.

Some Properties of Steam,[1] Prof. R. C. H. Heck.

A New Departure in Flexible Staybolts,[1] H. V. Wille.

Trips for the ladies to points of interest in and about the city at 10 a.m.

FRIDAY AFTERNOON

Trip by boat to Mount Vernon.

LOCAL COMMITTEE

Walter A. McFarland, *Chairman*

Gustav Ayres
Albert H. Buckler
Charles Eli Burgoon
Howard A. Coombs
James B. Dillard
William A. E. Doying
Charles E. Foster
H. A. Gillis
James Hamilton
Frederick E. Healy
Herman Hollerith
J. A. Holmes
Arthur E. Johnson
Frank B. King
Hervey S. Knight
Walter R. Metz
George L. Morton
Harold P. Norton
Willard L. Pollard
John E. Powell
Alfred H. Raynal
William B. Ridgely
W. E. Schoenborn
George R. Simpson
Charles F. Sponsler
Lucien N. Sullivan
William B. Upton
Charles V. C. Wheeler
Earl Wheeler

Committee of the Washington Society of Engineers

W. A. McFarland, Mem. Am. Soc. M. E., *Chairman*
A. E. Johnson, Mem. Am. Soc. M. E.
A. H. Raynal, Mem. Am. Soc. M. E.
W. E. Schoenborn, Mem. Am. Soc. M. E.
W. B. Upton, Mem. Am. Soc. M. E.
H. W. Fuller, Mem. Am. Inst. E. E.
John C. Hoyt, Mem. Am. Soc. C. E., Secretary, Washington Soc. Engrs.
D. S. Carll, Mem. Am. Soc. C. E., President, Washington Soc. Engrs.

Chairman of the Ladies Committee, Mrs. James Loring Lusk

THE UNIVERSITY CLUB OF WASHINGTON

The University Club of Washington, through Procter L. Dougherty, Chairman of the House Committee, has extended to the Society an invitation to make the club the headquarters for committee meetings, informal receptions, and a general bureau of information. The Society wishes to express its appreciation of this courtesy.

[1] To be presented by title or in brief abstract.

CONVENTION NOTES

The reception of the members and guests by President Taft will be one of the pleasant functions of the convention.

The address by F. H. Newell, Director of the U. S. Reclamation Service, will be of extraordinary interest. Mr. Newell is in a position to command a large view of this important branch of the government's work of reclamation and the lecture will be illustrated by colored lantern slides showing marvelous transformations of arid regions into beautiful and fertile home-sustaining lands.

It is possible that during the convention there may be an ascension of a dirigible balloon and an aëroplane. If so, the Secretary of War, Mr. J. M. Dickinson, proposes, provided the conditions are favorable, to invite the members and guests. Those who attended the addresses on aëronautics at the time of the annual meeting, given through the courtesy of Brig-Gen. Allen, Major Geo. O. Squier and Lieut. Frank P. Lahm, and saw the wonderful moving pictures of dirigible balloons and aëroplanes in flight, will appreciate in a measure the opportunity of witnessing an actual ascension.

A very interesting feature will be two exhibition drills which will be given by the United States troops stationed at Fort Myer. These will be held in the open field or in the riding hall, according to the condition of the weather, so that in any event the convention guests may depend upon seeing the drill in comfort.

On Thursday evening, the address by Past-President Geo. W. Melville, Rear-Admiral, Retired, and former Engineer-in-Chief of the Navy, on "The Engineer in the Navy," will undoubtedly prove highly interesting, as Rear-Admiral Melville is a noted speaker. Upon this occasion there will be presented to the historical series of paintings in the National Museum a portrait of Rear-Adm. Melville, painted by Sigismond de Ivanowski. It will be received for the Nation by Dr. Chas. D. Walcott, Secretary of the Smithsonian Institution. The portrait is presented by friends and admirers of Rear-Admiral Melville.

It is unnecessary to emphasize the pleasure and instruction of visiting the places of interest in Washington. That Congress will be in session at that time is an added attraction.

HOTEL ACCOMMODATIONS

Members should bear in mind that Congress will be in session at the time of the convention, and also that this is the most delightful season of the year in Washington. As a result the city has many visitors and a consequent large demand on its hotel accommodations. Members expecting to attend the convention should engage rooms immediately.

The letter from the hotel assigning rooms should be preserved, and presented at the time the rooms are demanded. Two days before arriving in Washington, the hotel should be notified of the exact time of expected arrival, referring to the letter engaging rooms. If one hotel cannot provide satisfactory accommodations, immediate correspondence with others will doubtless secure what is desired.

Hotel Rates for Spring Meeting at Washington
Minimum Rates

	American Plan				European Plan			
	Without Bath		With Bath		Without Bath		With Bath	
	Single Room	Double Room	Single Room	Double Room	Single Room	Double Room	Single Room	Double Room
New Willard	....	....	....	....	$2.50	$4.00	$3.50	$5.00
Shoreham	$5.00	$9.00	$5.50	$10.00	2.50	4.00	3.00	5.00
Arlington	5.00	10.00	7.00	12.00	2.00	4.00	4.00	6.00
Raleigh	....	....	....	....	2.00	3.00	3.00	4.00
Ebbitt	2.50	5.00	4.50	7.00	....	....	....	....
St. James	....	....	....	....	1.50	2.00	2.50	3.50
Cochran	4.00	7.00	4.50	9.00	....	....	....	....
Riggs	3.00	6.00	4.00	8.00	....	....	....	....
Normandy	3.50	6.00	4.00	9.00	1.50	3.00	3.00	4.00

If baggage is to be sent by express, checks can be given the baggage expressman immediately upon arrival. Trolleys leave the station for all hotels. Automobile passengers are allowed only a very small steamer trunk; carriage passengers, one medium-sized trunk. Extra baggage can be managed by taking as many carriages as there are trunks, or by sending some pieces by baggage express. The traveler wishing an automobile or carriage should give his checks to the uniformed porter immediately upon arrival as no carriages will be assigned to travelers until their baggage has first been brought to the platform in front of the station.

RAILROAD TRANSPORTATION NOTICE

Arrangements for hotel, transportation and Pullman car accommodations should be made personally.

Special concessions have been secured for members and guests attending the Spring Meeting in Washington, May 4–7, 1909.

The special rate of a fare and three-fifths for the round trip, on the certificate plan, is granted when the regular fare is 75 cents and upwards, from territory specified below.

a Buy your ticket at full fare for the going journey, between April 30 and May 6 inclusive. At the same time request a certificate, *not a receipt.* This ticket and certificate should be secured at least half an hour before the departure of the train.

b Certificates are not kept at all stations. Find out from your station agent whether he has certificates and through tickets. If not, he will tell you the nearest station where they can be obtained. Buy a local ticket to that point, and there get your certificate and through ticket.

c On arrival at the meeting, present your certificate to S. Edgar Whitaker, office manager at the Headquarters. A fee of 25 cents will be collected for each certificate validated. No certificate can be validated after May 7.

d An agent of the Trunk Line Association will validate certificates May 5, 6 and 7. No refund of fare will be made on account of failure to have certificate validated.

e One hundred certificates must be presented for validation before the plan is operative. This makes it important to ask for certificate, and to turn it in at Headquarters. Even though you may not use it this will help others to secure the reduced rate.

f If certificate is validated, a return ticket to destination can be purchased, up to May 11, on the same route over which the purchaser came, at three-fifths the rate.

This special rate is granted only for the following:

The Trunk Line Association:

All of New York east of a line running from Buffalo to Salamanca, all of Pennsylvania east of the Ohio River, all of New Jersey, Delaware and Maryland; also that portion of West Virginia and Virginia north of a line running through Huntington, Charleston, White Sulphur Springs, Charlottesville, and Washington, D. C.

The Central Passenger Association:

The portion of Illinois south of a line from Chicago through Peoria to Keokuk and east of the Mississippi River, the States of Indiana, and Ohio, the portion of Pennsylvania and New York north and west of the Ohio River, Salamanca and Buffalo, and that portion of Michigan between Lakes Michigan and Huron.

The New England Passenger Association, except via Bangor and Aroostook R. R., Rutland R. R., N. Y. O. & W. R. R., Eastern Steamship Co. and Metropolitan Steamship Co.:

Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut.

The Western Passenger Association offer revised one-way fares to Chicago, Peoria and St. Louis; these three places are points in the Central Passenger Association, and from these points travellers should purchase round trip tickets, in the manner outlined in the preceding paragraphs:

North Dakota, South Dakota, Nebraska, Kansas, Colorado east of a north and south line through Denver, Iowa, Minnesota, Wisconsin, Missouri north of a line through Kansas, Jefferson City and St. Louis, Illinois north of a line from Chicago through Peoria to Keokuk.

The Eastern Canadian Passenger Association:

Canadian territory east of and including Port Arthur, Sault Ste. Marie, Sarnia and Windsor, Ont.

TRAIN SCHEDULES

The following trains are suggested, via Pennsylvania Railroad.

Lv. New York, Tuesday, May 4	10.55 a.m.
Lv. North Philadelphia	1.00 p.m.
Lv. Baltimore	3.12 p.m.
Ar. Washington	4.15 p.m.
Lv. New York, Wednesday, May 5	12.10 a.m.
Lv. Baltimore	6.01 a.m.
Ar. Washington, Wednesday, May 5	7.12 a.m.
Lv. St. Louis, Monday, May 3	12.45 p.m.
Lv. Chicago	3.15 p.m.
Lv. Indianapolis	7.20 p.m.
Lv. Detroit	8.05 p.m.
Lv. Cincinnati	9.00 p.m.
Lv. Cleveland	11.30 p.m.
Lv. Columbus, Tuesday, May 4	12.45 a.m.
Lv. Pittsburg	7.30 a.m.
Lv. Baltimore	5.15 p.m.
Ar. Washington	6.22 p.m.

GENERAL NOTES

C. J. H. Woodbury, Mem. Amer. Soc. M. E., was appointed Honorary Vice-President to represent the Society at the annual meeting of the National Conference on Standard Electrical Rules held March 26.

HOTEL ACCOMMODATIONS

We wish to urge again the importance of definitely engaging rooms at the hotels in Washington well in advance of the Spring Meeting. Congress will be in session and Washington will have many visitors, so that the capacity of the hotels will be severely taxed. Members should make their reservations as early as possible and so secure comfortable accommodations.

STUDENT BRANCHES

The following Student Branches have been admitted to Affiliate Membership in The American Society of Mechanical Engineers:

Stevens Engineering Society; Polytechnic Institute Student Section; Armour Institute of Technology Section; Stanford Mechanical Engineering Association; Palo Alto Student Section; State Agricultural College of Oregon Student Section; Purdue University Student Section; University of Kansas Student Section; Cornell University Student Section.

DISTRIBUTION OF PAST ISSUES OF PROCEEDINGS

The Executive Committee of the Society has approved the reduction of the stock of past issues of the Proceedings with the exception of 50 copies of each number published previous to January 1907, and 75 copies of each number published during 1907.

After withholding these copies for the future demand, the balance of the stock, in accordance with the order of the Executive Committee, is to be distributed at the discretion of the Secretary among the Student Branches of the Society.

THE GAS POWER SECTION

The Gas Power Section during the last three months has been expanding its organization and development work. The Gas Power Membership Committee, with a largely increased personnel, has organized an auxiliary committee with members in the larger cities. Pamphlets and circulars illustrative of the purpose and activities of the Section have been prepared and circulated, and the Section membership shows a steadily increasing growth. In its work the committee has found many engineers eligible to membership in The American Society of Mechanical Engineers and proper membership blanks have been sent to them.

The Gas Power Meetings Committee has secured the following papers for the Washington Meeting:

- Offsetting Cylinders in Single-Acting Engines, by Prof. T. M. Phetteplace (published in the February 1909 Journal).
- A Method of Improving the Efficiency of Gas Engines, by Thos. E. Butterfield (published in the April 1909 Journal).
- A Comparison of Steam and Gas Power for Marine Service, by C. L. Straub (published in this issue).
- An Operating System for a Small Producer Gas Power Plant, by C. W. Obert (published in this issue).

The Gas Power Literature Committee has organized and is now at work. Arrangements are being made for the publication of the lists, abstracts and reviews so that they may be used to the best advantage of the profession.

The Gas Power Installations Committee has been busy preparing the forms for use in obtaining and recording the particulars of gas power installations. These forms will shortly be ready to go out and it is hoped that a partial report of the extent of the use of gas power may be ready for publication at the May Meeting.

The Gas Power Plant Operations Committee has organized and will devote its attention during the current year to representative plants from which full and accurate records may be obtained. Suitable forms will be prepared for the operating records of such plants and will be submitted to the Section for criticism. Several owners of gas power plants have asked the committee for copies of these forms in order that they may keep their own records in the best manner possible.

The stated meeting of the Gas Power Executive Committee was

held at the Engineers' Club on the evening of April 6. On the invitation of Fred R. Low, Chairman of the Gas Power Section, the Executive Committee and the Chairmen of the Gas Power Committees dined together at the Engineers' Club just before the meeting. The discussion, which was informal, covered the scope and methods of work of the Section and many suggestions were made and discussed. The work of the various committees was taken up and coördinated. The Secretary reported the membership of the Section as follows:

A. S. M. E. Members registered	168
Affiliates	106
Total	274

Appropriations were requested to carry the work of the Section through the summer.

MEETING OF ST. LOUIS ENGINEERS

On Saturday evening, April 10, 1909, a meeting of the members of the Society residing in St. Louis and vicinity was called by Wm. H. Bryan. E. H. Ohle was appointed Secretary. The meeting was attended by about 20 engineers.

The following topics were discussed: *a* Local organization with occasional professional and social meetings; *b* Increase in membership; *c* Contributions to The Journal; *d* Making up a party to attend the coming Spring Meeting at Washington, May 4–7; *e* Extending an invitation to the Society to meet in St. Louis at some future time; *f* Other means of promoting the Society's welfare, not only locally, but generally.

M. L. Holman, Past-President of the Society, thought that the object of local organizations of The Am. Soc. M. E. should be the widening of the influence of the Society, emphasizing its national aspect.

Professor Hibbard said one of the most important objects should be to exert an influence upon the engineering schools, and to benefit the engineers by promoting discussion of problems.

All present expressed themselves in favor of a local organization. It was voted that a committee of three composed of the chairman and two others appointed by him should be formed to lay out a plan of organization and to report in 60 days.

THE ORGANIZATION OF A LOCAL SECTION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Definite steps were taken at a meeting of 150 representative mechanical engineers of metropolitan Boston and nearby cities Friday evening April 16, for the organization of a local section of The American Society of Mechanical Engineers. The meeting was held in the auditorium of the Edison Building on Boylston street. This organization is made for the advancement of the local interests of the Society.

The movement started with an inquiry from a committee of the Boston Society of Civil Engineers as to the feasibility of forming a mechanical section of that Society. It soon became evident that a small proportion of the mechanical men in this vicinity are members of the Civil Engineers and it was decided to form a local section of The American Society of Mechanical Engineers of which there are about 350 members in the vicinity of Boston. The plan is, however, to maintain close relations with the local civil and other engineering societies.

A committee consisting of Prof. Ira N. Hollis, Prof. E. T. Miller and Messrs. Charles T. Main, I. E. Moultrop and Joseph W. Libby, members of this Society as well as of the Boston Society of Civil Engineers was chosen to arrange for future meetings and adopt such plans as are necessary for the development of the new local society.

The first meeting was addressed by Jesse M. Smith, President; Calvin W. Rice, Secretary, Fred R. Low, Chairman of the Gas Power Section, H. F. Bryant, Vice-President of the Boston Society of Civil Engineers, and several other men prominent in engineering circles.

THE BROOKLYN POLYTECHNIC STUDENT SECTION

The Brooklyn Polytechnic Student Section of the Society has organized under an Honorary Chairman, Prof. W. D. Ennis, Professor of Mechanical Engineering of the Polytechnic; a Chairman, James Russell; a Secretary, Percy Gianella; and a Governing Committee composed of James Russell, *Chairman*, Russell H. Brown, W. M. Sar Vant, and Percy Gianella.

The following committees have been selected: on Program, Chas. W. Gremple, *Chairman*, A. T. Smith, Vinton Smith, Alphonse A. Adler, W. J. Moore, Oskytel H. Clarke, F. Rhey Baldwin; on Admission, J. M. Wiley, *Chairman*, Clemente Hidalgo, W. E. W. Moore, Wesley M. Graff, Herman F. Weber, S. W. Berliner, Morgan L.

Woodruff; on Employment, M. G. Farrell, *Chairman*, Alfred Helwig, Wm. H. Brendlin. At the meeting April 3 the Committee on Admission proposed ten students for election, who were declared elected by the Governing Committee. The Committee on Employment reported that they had received communications stating that three positions were open to students, two as draftsmen, one collecting engineering material for a magazine.

THE JOINT CONSERVATION COMMITTEE

The work of conservation, until recently carried on by the Conservation Commission will now be advanced by the Joint Conservation Committee, of which the Hon. Gifford Pinchot is Chairman and Thomas R. Shipp is Secretary. The other members forming the Committee are: George C. Pardee, *California*; Knute Nelson, *Minnesota*; W. H. Milton, *Florida*; W. K. Kavanaugh, *Missouri*; Newton C. Blanchard, *Louisiana*; Paris Gilson, *Montana*: O. J. Salisbury, *Utah*.

THE PANAMA CANAL

J. Edward Simmons, president of the Chamber of Commerce, has appointed on the committee of seven to make a study, from the standpoint of the requirements of the world's shipping, of the problems involved in the construction of the canal at Panama. The committee appointed is composed of John R. Dunlap, Alfred P. Boller, Cornelius A. Pugsley, William L. Saunders, Mem. Am. Soc. M. E., Jacob W. Miller, Julio F. Sorzano, Mem. Am. Soc. M. E., and John D. Crimmins. The committee held its first meeting March 19.

NORTHWESTERN UNIVERSITY

On March 25 the Northwestern University at Evanston, Ill., inaugurated the Swift Hall of Engineering, a $100,000 building, presented by Edward F. Swift and his mother, Mrs. Gustavus F. Swift, of Chicago, together with $50,000 for maintenance. The University has organized a College of Engineering of which John Fillmore Hayford has been appointed Director. The engineering course offered will cover five years. At the end of the first four years the degree of Bachelor of Science will be conferred and the degree of Bachelor of Engineering will be given for an additional year of study. In general, the purpose underlying the instruction in this new college

of engineering is to teach broad fundamental principles, devoting special attention to the cultural studies in the earlier years of the course, allowing students to specialize later.

At the dedication of the Engineering Building, which will take place May 7, Mr. Charles Whiting Baker, Mem. Am. Soc. M. E., and Editor of the *Engineering News*, will make the principal address which will be on a broader training for the engineer.

MEETING OF THE COUNCIL

The regular meeting of the Council was held April 13, 1909, in the rooms of the Society, the President, Jesse M. Smith, in the Chair. There were present: Messrs. Basford, Bond, Breckenridge, Carpenter, Gantt, Humphreys, Hutton, Moultrop and Swasey.

The following deaths were reported: Jasper R. Rand, and C. L. Hildreth.

The following resignations were reported: C. J. Carney, E. R. Behrend and Fred Collins.

The President reported the following committee appointments: ***Finance***, George J. Roberts, in place of J. Waldo Smith, resigned; ***Involute Gears***, Wilfred Lewis, Hugo Bilgram, Gaetano Lanza, Chas. R. Gabriel and C. W. MacCord; ***Research***, R. C. Carpenter, James Christie, Charles B. Dudley, W. F. M. Goss and Richard H. Rice.

Voted: That the Secretary be instructed to procure art photographs of the past-presidents, an appropriation of $390 to be made for this purpose.

Amendments: The amendments to By-Laws 17, 27 and 28 were accepted subject to the approval of the Committee on the Constitution and By-Laws.

Resolved: That the amendment in the "Instructions for By-Laws" presented and recommended by the special committee of five (appointed at the joint meeting of the Standing Committees, called by the President to consider the relations of the Standing Committees to the appropriations for the work of the respective committees) be adopted, and that all present instructions conflicting therewith be and are hereby made null and void.

Resolved: That the Secretary be instructed to present to the Executive Committee a draft of such changes in the "standards" of the Society as may be necessary to bring them up to date, and to make them in complete harmony with action taken from time to time by the Council since the "standards" were established and adopted; and that these changes, when approved by the Executive Committee, shall be presented for adoption by the Council, as provided in the By-Laws.

STANDING COMMITTEES

Finance Committee: The following resolution was presented from the Finance Committee, and was adopted on motion:

Whereas, $2222.50 was raised as a special fund to take care of the entertainment expenses of the annual meeting,

Be it Resolved: That the Finance Committee recommend to the Council that the cost of entertainment at the annual meeting amounting to $2002.24, now charged to the appropriations of the Meetings Committee, be charged to this special fund, and the balance be held as a special fund for similar use at future meetings.

House Committee: The following record from the minutes of the House Committee was presented:

It was voted that the Committee adopt the plans and specifications prepared by the architect of the building the entire work to cost approximately $5400, and that the Committee instruct the Chairman to ask of the Council an appropriation of $2500 for this year, to be expended in a manner that the Committee may deem best in their judgment.

Resolved: That the Council approve the recommendation of the House Committee, including an appropriation of $2500 for these objects, to be expended as the House Committee may deem best.

Resolved: That the allocation of the charges for this work to operating and capital accounts be referred to the Finance Committee with power.

SPECIAL COMMITTEES

The Committee on Revision and Extension of the Code for Testing Gas Power Machinery, Chas. E. Lucke, *Chairman,* E. T. Adams, George H. Barrus, D. S. Jacobus, and Arthur West, made a general report and requested that they be discharged and a new committee appointed to revise, unify and standardize all the present codes of the Society on their various subjects. This report was received and the Committee discharged.

Voted: That nine members be appointed by the President, with the approval of the Council, a Committee on Power Tests, to revise the present testing codes of the Society relating to boilers, pumping engines, locomotives, steam engines in general, internal combustion engines, and apparatus and fuels therefor, and to extend these codes so as to apply to such power generating apparatus as the present codes do not cover, including water power, and bring them into harmony with each other and with the best practice of the day. This Commit-

tee may resolve itself into as many sub-committees as necessary, to coöperate with and report to the whole committee. That the committee be empowered to confer with the American Institute of Electrical Engineers, regarding electrical matters pertaining to the subject, and with any other engineering societies or organization which have formulated rules for similar tests, with a view to obtaining general coöperation of authorities in the proposed work.

Boiler Code: The committee, consisting of Messrs. Lieb and Taylor, appointed to investigate the advisability of a revision of the Standard Code on Steam Boiler Tests, reported that in their opinion it is desirable to undertake a revision of the Standard Code for Boiler Tests in view of the progress made in the art since the Standard Code was formulated.

The application of blast furnace gases, gas producer plants, oil fired furnaces and other important developments, make it desirable to bring the standard code up to date so as to include also provisions for gaseous and liquid as well as solid fuels. It may be desirable also in the revised code to give consideration to the question of a standard method for the sampling and testing of fuels.

The Committee on the Conduct of the Annual and Spring Meetings, F. R. Hutton, Ambrose Swasey and F. M. Whyte, reported that it recommends that the Meetings Committee be authorized in its discretion to contribute $300 toward the local expense of each semi-annual meeting, such sums to include the expense of the meeting hall, and to be expended by the Local Committee provided for in R14. That in the annual meeting the cost of the President's Reception be borne by the Society and that the reception be open to all members and their guests. That in the case of both the Annual and Spring Meetings the Local Committee shall collect all the money for the social entertainment and disburse the same.

The Committee on The Journal, F. R. Hutton, George M. Basford and C. W. Rice, presented its report, which was duly accepted, specially endorsing the following principles: that the results should be attained within the income of The Journal, which should be self-supporting; and that net income therefrom, or so much of it as may be needed, should be kept available for its constant improvement.

The following resolutions were adopted and the Secretary requested to notify any committees affected by this action: The following By-Law was adopted and will be given its proper number.

THE JOURNAL

a

The Council shall institute a monthly publication to be called The Journal, which shall be under the management of the Secretary who shall act under the general supervision of the Publication Committee, subject to approval by the Council as to the policy thereof and the expenditures therefor.

b

Resolved: That By-Laws B25 relating to the duties of the Publication Committee be amended by adding in line 6 after the word "Society" the following sentence: "The Committee shall have the general supervision of the monthly publication of the Society known as 'The Journal.'"

c

Resolved: That the Council apportion under By-Law B21 to the Publication Committee of the Society, the work of general supervision of The Journal.

d

Resolved: That By-Law 23, relating to the duties of the Finance Committee, be amended by adding at the end:

"It shall have charge of the making of all contracts for printing in the Society's work, and the ordering of all expenditures thereunder."

e

Resolved: That under the provision of By-Law B21 the Council apportion to the Finance Committee the work of the supervision of all printing contracts for the Society's work, and that the Secretary, acting as Business Manager, carry out the directions of the Finance Committee therefor, as provided in that By-Law.

Voted: That the report of the Committee on The Journal be referred to the Publication and Finance Committees for report to the Council at its next meeting. It was the sense of the Council that the Publication Committee should enter immediately upon its duties of general supervision of the Journal without waiting for the formality of adoption of the by-laws involved.

Shop Section: The petition of certain members of the Society to form a Machine Shop Section was presented and referred to a special committee to consist of F. R. Hutton, *Chairman,* Alex. Humphreys, R. H. Fernald, H. H. Suplee, Fred W. Taylor (formerly Committee on Affiliated Societies) for report at the next meeting of the Council.

The Council adjourned to meet in Washington, Tuesday, May 4, at an hour to be determined later.

JOHN FRITZ MEDAL AWARD

The John Fritz Medal, the only medal which the four National Engineering Societies confer, was presented to Charles T. Porter, Honorary Member of The American Society of Mechanical Engineers, on Tuesday evening, April 13. The presentation took place in the auditorium of the Engineering Societies building, 29 West 39th St., before distinguished invited guests and an audience representing the entire engineering profession. The medal was conferred upon Mr. Porter for his work in advancing the knowledge of steam engineering and for improvements in engine construction. Addresses were made by Dean W. F. M. Goss of the University of Illinois, upon The Debt of Modern Civilization to the Steam Engine as a Source of Power; by Prof. F. R. Hutton of Columbia University, Honorary Secretary of The American Society of Mechanical Engineers, on The Debt of the Modern Steam Engine to Charles T. Porter; by Robert W. Hunt, of Chicago, on The Debt of the Era of Steel to the High Speed Steam Engine; by Frank J. Sprague, of New York, on The Debt of the Era of Electricity to the High-Speed Steam Engine.

The John Fritz Medal was established by the professional associates of John Fritz of Bethlehem, Pa., in 1903, upon the occasion of his eightieth birthday, to perpetuate the memory of his achievements in industrial progress. Its award was placed under a Board consisting of four members from each of the four National Engineering Societies, the American Society of Civil Engineers, the American Institute of Mining Engineers, The American Society of Mechanical Engineers, and the American Institute of Electrical Engineers.

Awards have been made to Lord Kelvin for his work in cable telegraphy and other scientific achievements; to George Westinghouse for the invention and development of the air brake; to Alexander Graham Bell for the invention and introduction of the telephone; to Thomas Alva Edison for his electrical inventions and developments.

Henry R. Towne, Past-President, Am. Soc. M. E., and Chairman of the Board of Award of the John Fritz Medal for 1909–1910, presided at the meeting, and in his opening remarks spoke briefly of the origin and history of the medal. He introduced Dean W. F. M. Goss of the University of Illinois, whose address preceded the presentation.

At the close of Professor Goss' address, Mr. Towne in a short intro-

ductory speech recalled that Mr. Porter is the third person and the first American to whom has been accorded the distinction of Honorary Membership in The American Society of Mechanical Engineers. On account of this relation, Mr. Porter was introduced by Jesse M. Smith, President of the Society. As the award was made by the Board of last year, under the chairmanship of E. Gybbon Spilsbury, the presentation was made by Mr. Spilsbury. Mr. Towne then introduced Mr. Smith, who said in introducing Mr. Porter:

The John Fritz Medal, established in 1902 by the American engineering profession as a meed of recognition for 'notable scientific or industrial achievement,' was awarded in the year 1908 by a board representing the four National Engineering Societies, to a distinguished mechanical engineer for 'his work in advancing the knowledge of steam-engineering and for improvements in engine construction.' I present to you, and to this company, the engineer to whom this high distinction has been granted.

He is honored because he saw the possibilities of the high-speed steam engine; because his mechanical genius in design made those possibilities real; and because he recognized the necessity for, and then applied, the very best mechanical construction to the realization of his ideals.

He then introduced into the development of the power plant, an idea and an influence so revolutionary as to make an epoch in the history of the art of engine building; and which has been as world-wide in its effects as the use of the reciprocating engine.

Many of the present generation of engineers have inherited, without effort and often without knowledge of their origin, the results which cost him many years of painstaking study and experiment to establish.

That he may receive the John Fritz Medal awarded to him, I now have the honor to present Charles Talbot Porter.

E. Gybbon Spilsbury, in presenting the medal to Mr. Porter, said:

Under instructions from the Board of Award of the John Fritz Medal, it is my privilege and pleasure to inform you that for your work in advancing the knowledge of steam engineering and for improvements in engine construction, you have been chosen as the worthy recipient of the medal for the year 1908–1909.

This medal was instituted in 1902 to commemorate the 80th anniversary of the successful and honored career of our beloved colleague John Fritz, and its award by a committee selected from the membership of the four great engineering societies of the United States is the highest honor which the engineering profession can onfer on any of its members.

Charles Talbot Porter, in the presence of this distinguished company, I now present you this medal, together with an engraved certificate of the award, and confer upon you all the rights and honors and the distinction which attach to this emblem. May you live long and happily to enjoy the appreciation which is your due at the hands of those you have so benefited by your work.

After the presentation, Mr. Towne read the following telegram from John Fritz:

"With all my heart regret my inability to be with my dear friends and associates this evening. I cannot be with you in person, but I will be with you in spirit. Please convey to my dear friend Porter my sincere congratulations and best wishes."

The addresses of the evening followed, abstracts of which are published in this report.

Professor Hutton read this congratulatory cablegram from Wm. H. Moore, Editor of *London Engineering:* "Heartiest congratulations to Porter," and a cablegram from the younger generation of Wm. A. Hoyle, with whom Mr. Porter was associated in his early work, which read: "All Hoyles congratulate Porter in our father's memory." The Iron and Steel Institute of Great Britain cabled: "The Iron and Steel Institute warmly approves of what has been awarded in recognizing the excellent work of Porter." From the Institution of Mechanical Engineers of Great Britain: "Goodwill and sympathy on the occasion of the presentation of the John Fritz Medal and congratulations to the recipient." From E. D. Leavett, Mem. Am. Soc. M. E., an early associate of Mr. Porter, a telegram of heartiest congratulations was received, and many other telegrams and cablegrams which were not read on account of lack of time.

In closing, Mr. Towne proposed a rising vote of good wishes for continued health, success and long life to the founder of the medal, John Fritz, and to the recipient, Charles T. Porter.

Abstracts of the several addresses here follow:

ADDRESS BY DEAN W. F. M. GOSS

Dean W. F. M. Goss spoke of the debt of modern civilization to the steam engine. Dreams of the possibilities of steam belong to the day of Addison, Steele, Swift and Defoe; days when there were brilliant men of letters, triumphs in architecture, achievements on the battlefield, but when there were no means for performing industrial work. There were no large factories in England because there was no way by which their machinery could be driven. Mines were abandoned because they were flooded with water; women and girls were toiling in the mines amid suffering and degradation. The movement of merchandise by land was laborious and travelling by sea slow and dangerous.

Into the midst of such conditions came the steam engine. It freed the mines of England from water, revived dormant industries, introduced new systems of manufacture, supplied power, water and effective means of sanitation to cities, supplemented in all these respects in later

years by electric transmission for lighting, power and transportation. Steam usurped the place of wind in the propulsion of ships, and through the agency of the locomotive has carried civilization to the farthest ends of the earth. These achievements are direct contributions to the upbuilding of civilization, the key-note of which is service. The dwellers on the earth are beginning to see that if one nation suffers severely, all are likely to suffer in some degree and they are learning sympathy for their fellow-men.

ADDRESS BY PROF. F. R. HUTTON

It was assigned to Prof. F. R. Hutton to speak in detail of the debt which the reciprocating steam engine owes to the pioneer work of Mr. Porter. This debt may be grouped under five heads.

First, the reciprocating engine owes to him the first vision of the advantages that come from making the crank shaft turn at a high rate of revolution, whereby the weight of the motor per horse power is reduced. From this seed-thought has sprung the modern design of the motor for the self-propelled vehicle and for the aëroplane. The high speed involved the solution of difficult problems, owing to the necessity for starting and stopping heavy parts of the mechanism in each revolution.

The second debt is for Mr. Porter's recognition of these problems.

The third debt, perhaps the most important of all, is that the standard of mechanical construction in the high-speed engine must be of the highest type. We owe to Mr. Porter many manufacturing details which now are commonplaces of modern practice.

Fourth, Mr. Porter created a form of steam engine condenser to be attached directly to the engine and operated at a much higher rate of speed than that at which the ordinary pump could be used; and finally, invented a sensitive steam engine governor in two forms.

The address closed with a tribute to Prof. Chas. B. Richards, associated with Mr. Porter's early work of designing, and John F. Allen, who had conceived many details of the first high-speed engine which Mr. Porter combined into a harmonious whole.

ADDRESS OF ROBERT W. HUNT

Robert W. Hunt said it was scarcely conceivable that one could have witnessed in a single lifetime the remarkable development in the steel industry which he had observed since the birth of the Bessemer processes. These accomplishments were made practically pos-

sible by the application of a more rapid power. The early processes were deliberate because man was habituated to slow movements. The first power came from the slow-turning water wheel; later from the slow-speed steam engine. Faster movements were obtained through gears and belts. Among the first engineers to attach the rolling mill engine direct to its train of rolls were John and George Fritz, but the speed of their strokes was limited. Mr. Charles T. Porter was the first to give the rolling mill engineer a controllable direct-connected economical high-speed engine.

Mr. Hunt referred to two engines in a rolling mill plant in Troy, N. Y., in 1876. One set of rolls was driven by a walking beam low-pressure engine, taken from the steamboat Swallow, a Hudson River boat, and the other set was driven by Porter-Allen engines. The contrast between the steamboat engine with a slow speed of 35 or 40 r.p.m., and Mr. Porter's little engines, humming away at high speed, and accomplishing much greater results, was an educational sight.

ADDRESS OF FRANK J. SPRAGUE

Frank J. Sprague recalled that in 1867, at the French exhibition, Charles T. Porter installed two Porter-Allen engines, the only high-speed engines exhibited, to drive generators for supplying current for lighthouse apparatus. While these engines were not directly coupled, it is a curious fact that the piston speeds and revolutions were what is common today in isolated direct coupled plants. In the dozen years following, Mr. Porter built many engines with certain common characteristics, high piston speed and revolutions, solid engine bed and babbitted bearings, but there was no electric driving until 1880, when Mr. Porter installed a high-speed engine for Mr. Edison in his laboratory at Menlo Park. Shortly after this Mr. Porter was invited to construct for the Edison Station at Pearl Street, New York, the first of a series of engines for so-called steam dynamos, each independently driven by a direct coupled engine.

Mr. Sprague likened the relations of electricity and the high-speed engine, not to debtor and creditor, but rather to a close partnership, an industrial marriage, one of the most important in the engineering the world, that of prime mover and the electric generator. Here were two machines, destined to be joined together, economizing space, increasing economy, augmenting capacity, reducing investment, increasing dividends. Primarily, and largely due to Mr. Porter, the high speed possibilities of the engine were commercially demonstrated.

The following distinguished guests occupied seats on the platform:

Rear-Admiral Geo. W. Melville, John E. Sweet, C. A. Parsons, Jesse M. Smith, Charles T. Porter, Henry R. Towne, E. Gybbon Spilsbury, Prof. Chas. B. Richards, Jas. C. Brooks, Alfred Noble, Ambrose Swasey, Onward Bates, G. G. Ward, Chas. L. Clarke, W. H. Pegram, Prof. F. R. Hutton, Prof. W. F. M. Goss, R. W. Hunt, Frank J. Sprague, A. H. Pickler, C. Warren Hunt, S. S. Wheeler, E. Swennson.

MEMORIAL

ALFRED R. WOLFF

By Prof. J. E. Denton, Stevens Institute of Technology

Alfred R. Wolff, who died at his home in New York on January 7, 1909, was born in Hoboken, March 15, 1859. He entered the Stevens Institute of Technology with its class of 1876, when less than 14 years of age. He nevertheless easily carried the studies of the four years course, and was recognized as one of the leading students of a strong class.

His graduating thesis on windmills, which contributed original experimental data to the theory of the subject, was published through several numbers of the *Engineering and Mining Journal* of 1876, with favorable editorial comment. This thesis, supplemented by a compendium of modern American windmills, with tabular statements of their power and relative economy in practice, was published in 1885 by Wiley & Sons, in book form, under the title, The Wind Mill as a Prime Mover, and remains the only book on this subject.

After graduation, Mr. Wolff entered the office of the late C. E. Emory, then consulting steam engineer of New York and also consulting engineer to the U. S. Revenue Marine Service.

About 1880, Mr. Wolff decided to build up a practice as consulting engineer in New York. For about eight years his work consisted in the miscellaneous commissions of the steam expert. During this time he wrote several articles, among them a paper on The Value of the Study of the Mechanical Theory of Heat, presented at the first meeting of The American Society of Mechanical Engineers, of which he was a charter member; a series of editorial articles on steam and energy questions, which appeared in *The American Engineer*, with whose staff Mr. Wolff was connected for several years, and a supplement to Robert Briggs' essay on Steam Heating, published in the Van Nostrand Science Series.

In 1888 Mr. Wolff was engaged to assist the architect of the New York Freundschaft Club to complete its heating and ventilating plant. This engagement proved to be his opportunity to secure a lucrative specialty. At this time the architect depended for the design of the heating and ventilating plant upon the largely gratui-

tous plans and specifications of the prospective contractor and consequently the heating and ventilating requirements of a building were liable to be sacrificed in undue proportion to their importance. Obviously there was field for a middleman as the authorized agent of the architect.

In establishing himself in this field, Mr. Wolff encountered many difficulties which he overcame so successfully that at the end of six years he had referred to him more problems of heating and ventilating than he could execute. It was during this time that he wrote and published the pamphlet entitled The Ventilation of Buildings, an outline of the elements of physics, chemistry, and mechanics involved in the design of a heating and ventilating plant.

He introduced, from the German practice, in 1893, the "heat-unit system," under which the radiator surfaces for direct heating in a building are systematically calculated from the heat lost by the various thicknesses of walls and proportion of window surface. This was a substitute for the crude American rule, previously in vogue. allowing a square foot of radiator surface per various cubic feet of room contents; depending entirely on the judgment of the engineer.

He made popular the use of the combined plenum and exhaust system operating with "tempered" air, for ventilation, supplemented by direct radiators to supply the loss of heat by walls and windows[1] as a substitute for the "switch-damper" method of heating and ventilating formerly prevailing in the metropolitan district.

He introduced the thermostat in high-class residence work in 1893; and in 1902, he stimulated Johnson to apply this mechanism to the automatic control of humidity. This automatic "humidostat" was first successfully applied in the Carnegie residence.

Mr. Wolff introduced the use of the cheese-cloth filters, for straining the dust out of the air drawn into a building for indirect heating, into the metropolitan district in 1894, for use in the New York Life Building. He installed a heating and ventilating plant in the Board Room of the New York Stock Exchange in which the problems of constant temperature and constant hydrometric conditions were successfully met. The refrigerating feature of this plant is the only example of the artificial control of summer heat in an office building, and as such it is a unique monument to Mr. Wolff's ability.

[1] Mr. Wolff illustrated the application of this combination together with the "heat unit system," in a lecture before the Franklin Institute in 1894, which was published in pamphlet form under the title The Heating of Large Buildings.

Mr. Wolff took part in the organizations of the Ethical Culture Society, especially in the maintenance of their charitable schemes. He was also an alumni trustee of the Stevens Institute of Technology from 1893 to 1896 and a permanent trustee after 1900.

Among a great many important buildings in which Mr. Wolff installed heating and ventilating plants are the following: Century Club; Waldorf-Astoria Hotel; Carnegie Music Hall; Lakewood Hotel, Lakewood, N. J.; United Charities Building; University of the City of New York; New York Herald Building; C. Vanderbilt residence; Teachers College; J. J. Astor residence; St. Regis Hotel; the Lying-in Hospital; Princeton Library; Brooklyn Institute; Columbia University; Sherry's Hotel; Delmonico's Hotel; University Club; Hotel Martinique; American Museum of Natural History; Cornell Medical College; Carnegie residence; Library of J. P. Morgan, Esq.; Hispanic Museum; Evening Post Building; Plaza Hotel.

NECROLOGY

A. KENNEDY ASHWORTH

A. Kennedy Ashworth, manager of the filter department and traveling engineer of the Pittsburg Gage and Supply Co., died January 20, 1909, at his home in Crafton, Pa. He was born May 26, 1873, in Covington, Ky., receiving his education in the schools of Pittsburg, Pa., and in the Cook Academy; he was also a graduate in Mechanical Engineering of Rose Polytechnic, and studied at the Western University of Pennsylvania.

He first entered the employ of the Joseph Horne Co. as mechanical engineer, and became chief engineer of their steam and electric plants. After about two years he became a member of the firm of D. Ashworth & Son, consulting engineers. He associated himself with the Pittsburg Gage and Supply Co., and was actively engaged in engineering work after that time, except for a short period when he was connected with the Buckeye Engine Co., establishing a Boston office. He also established offices for the Pittsburg Gage and Supply Co. in Philadelphia, New York, Chicago and other large cities.

He was a member of the Engineers' Society of Western Pennsylvania, the order of Free and Accepted Masons, and the Sons of the American Revolution, of Boston. He was formerly a member of the Shady Avenue Baptist Church, East End.

JASPER R. RAND

Jasper Raymond Rand, vice-president and director of the Ingersoll-Rand Co., New York, died in Salt Lake City, Utah, March 30, 1909. He was the son of Jasper Raymond Rand, one of the founders of the Rand Drill Co., and was born in Montclair, N. J., September 3, 1874.

He was graduated from Cornell University in 1898 with the degree of Mechanical Engineer, and served in Porto Rico in the Spanish-American war as a member of the 1st New York Volunteer Engineers. During 1899–1900 he was president of the Imperial Engine Co. at Painted Post, N. Y., which position he left to take the presidency of the Rand Drill Co. In 1905 he was elected vice-president and director of the Ingersoll-Rand Co., the position he held up to the time of his death.

Mr. Rand was a member of the Alpha Delta Phi Fraternity, the Spanish War Veterans, the American Institute of Mining Engineers, the Engineers' Club, the Cornell Club and the Alpha Delta Phi Club of New York.

CHARLES LEWIS HILDRETH

Charles Lewis Hildreth was born October 9, 1823, at Concord, N. H., and died suddenly on February 26, 1909, at Westford, Mass. He received his education at a private school in Nashua, N. H., and at the Appleton Academy in New Ipswich, N. H.

In 1845 he went to Lowell, Mass., and became an apprentice in the Lowell Machine Shop, which was incorporated the same year. After a service of three years, he became a contractor on piecework. He was identified for over fifty years with this company, being superintendent for twenty-six years. During the great depression of the iron trade in 1858 he went to Philadelphia and served as foreman in the Industrial Works. He returned to Lowell, Mass., in 1860, and assumed charge of the shop as general foreman, a position he held until 1879 when he was made superintendent of the entire plant. Mr. Hildreth was identified with the textile machinery trade during almost the entire period of its development in America.

In July 1905 he retired from business to his country home in Westford, Mass., where his death occurred.

He was president of the Mechanics Savings Bank in Lowell, Mass., was closely identified with the Lowell Textile School, and while in Lowell was an attendant at the Kirk Street Congregational Church; in Westford he attended the Union Congregational Church.

OTHER SOCIETIES

AMERICAN ELECTROCHEMICAL SOCIETY

The annual meeting of the American Electro-chemical Society will be held at the Clifton Hotel, Niagara Falls, Canada, on May 6, 7 and 8. A feature of special interest will be a symposium of papers on the electro-metallurgy of iron and steel. The whole first day, May 6, will be devoted to this subject. On the evening of Thursday the address of the retiring president, Dr. Edward G. Acheson, will be delivered.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

The first session of the annual meeting of the American Railway Engineering and Maintenance of Way Association was held on Tuesday morning, March 16, at Chicago. After the president's annual address, reports of the various committees were submitted. The following officers for the ensuing year were elected:

President, William McNab; First Vice-President, L. C. Fritch; Second Vice-President, W. C. Cushing; Treasurer, W. S. Dawley; Secretary, E. H. Fritch; Members of Board of Directors, three years each, A. H. Rudd, A. W. Thompson.

PITTSBURG FOUNDRYMEN'S ASSOCIATION

At the April 5 meeting of the Pittsburg Foundrymen's Association, held at the Fort Pitt Hotel, Efficiency in Plant Organization and Operation was discussed. Harrington Emerson, Mem. Am. Soc. M. E., addressed the association on Modern Productive Relations between Shop Officials and their Subordinates and the Modern Theory of Profit Sharing. This was followed by an interesting discussion.

ST. LOUIS RAILWAY CLUB

At the April 9 meeting of the St. Louis Railway Club, H. Wade Hibbard, Mem. Am. Soc. M. E., Professor of Mechanical Engineering at the University of Missouri, presented a paper on Organization. There was a demonstration of autogenous welding by oxy-acetylen.

NEW ENGLAND STREET RAILWAY CLUB

On March 25 the New England Street Railway Club held its annual meeting and banquet at the Hotel Somerset, Boston. W. D. Wright of Providence, R. I., was elected president. D. L. Prendergast of Boston was toastmaster. Among the speakers were James F. Shaw, J. F. Jackson and P. F. Sullivan.

NEW YORK RAILROAD CLUB

On March 19, the annual electrical night of the New York Railroad Club, the subjects generally discussed were, The Approaching Transfer of the Electrification Problem and Standardization. Those who participated were: William McClellan, Mem. Am. Soc. M. E.; Edwin B. Katte, Mem. Am. Soc. M. E.; Henry G. Stott, Mgr. Am. Soc. M. E.; C. L. de Muralt and N. W. Storer, of Pittsburg.

NEW YORK ELECTRICAL SOCIETY

A meeting of the New York Electrical Society was held at the New York Hippodrome, March 31. At the conclusion of the regular hippodrome performance the members assembled on the stage and were addressed by Arthur Williams on the Electrical Equipment of the Hippodrome.

PROVIDENCE ASSOCIATION OF MECHANICAL ENGINEERS

On Tuesday evening, March 23, at the Technical High School Hall, D. J. Butts of New York gave an address on Electric Drives before the Providence Association of Mechanical Engineers. The speaker explained the advantage of electricity over belting both as regards economy of power and freedom from fire hazard. After the lecture, Mr. Butts illustrated by means of lantern slides the application of motor drives to a great variety of machines.

MUNICIPAL ENGINEERS OF THE CITY OF NEW YORK

At the March 24 meeting of the Municipal Engineers of the City of New York, Herman W. Merkel, Chief Forester, New York Zoölogical Park, presented a paper on Some Interesting American Trees, which was illustrated by lantern slides.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The American Institute of Electrical Engineers devoted their meeting in New York April 16 to a discussion of Industrial Education. A paper was presented by Herman Schneider, Dean of the College of Engineering of the University of Cincinnati, treating of the Fundamental Principles of Industrial Education.

Mr. Schneider stated that the problem is, what industrial training should the public schools give. It is obviously impossible to train children in the public schools for all the trades which the industries of even a small town require, and who shall decide which are the more important trades, and how shall public support be obtained from all sources to support the training in these few trades? There is involved in the problem justice to the children and justice to the taxpayer.

Mr. Schneider offered as a solution of the problem a system of coöperation between schools and factories for the efficiency training and civic training of young people after they have found their work.

He advocates a coöperative system, where the technique or practice is taught in the shop, and the science underlying it is taught by skilled teachers. Mr. Schneider describes a coöperative school at Fitchburg, Mass., where the students are divided into groups which alternate every week—one-half being in the day school and the other half in the factories. The course in Fitchburg is of five years' duration, and at the end of that time the student has been taught the simple science underlying his trade, shop mathematics, and a certain amount of cultural work. In addition he has become a fair mechanic. The money earned every alternate week, and during full time in summer, supplies the simple wants of the children and enables them to go to school when otherwise they would have to become little breadwinners.

The directors of the American Institute of Electrical Engineers have made the following nominations for officers to be elected at the annual meeting in May: President, L. B. Stillwell, New York; Vice-Presidents, J. J. Carty, New York; Paul M. Lincoln, Mem. Am. Soc. M. E., Pittsburg; Paul Spencer, Philadelphia; Managers, A. W. Berresford, Milwaukee, W. S. Murray, New Haven, H. H. Norris, Ithaca, S. D. Sprong, New York; Treasurer, George A. Hamilton, New York; Secretary, Ralph W. Pope, New York.

BOSTON SOCIETY OF CIVIL ENGINEERS

The annual meeting of the Boston Society of Civil Engineers was held at the house of the Boston City Club on Wednesday, March 17. The reports of the officers and the various committees were submitted at the business meeting, after which Pres. J. R. Worcester delivered his annual address. The officers elected for the coming year are as follows: President, Geo. B. Francis; Vice-President, Charles T. Main, Mem. Am. Soc. M. E.; Secretary, S. Everett Tinkham; Treasurer, W. S. Johnson; Librarian, Fred. I. Winslow; Director, Fred. H. Fay.

BROOKLYN ENGINEERS' CLUB

At the meeting of the Brooklyn Engineers' Club held April 8, J. E. Jennings presented a paper entitled Steel Transmission Towers, illustrated by lantern slides, in which he discussed their design, tests, shopwork and galvanizing, shipping and erection.

ENGINEERS' CLUB OF PHILADELPHIA

At the April 3 meeting of the Engineers' Club of Philadelphia, A. Fred Collins presented a paper entitled, Wireless Telegraphing and Telephoning. The paper consisted of a demonstration of certain forms of apparatus used in this connection. The Junior Section of the club met on the evening of April 12. The paper of the evening was Mining and Prospecting, presented by A. B. Richmond. The April 17 meeting of the club was devoted to a paper on Interurban Railways, by Benjamin Franklin. This paper was illustrated by lantern slides.

MODERN SCIENCE CLUB

At its meeting April 6, in its club house, the Modern Science Club of Brooklyn was addressed by Chas. A. Lundell, of the Thompson-Bonney Co., who spoke on Electric Motor Design. The speaker touched upon the experiments of Faraday and Siemens, and talked of the theory underlying armature and field design, especially as regards the effects of the use of various grades of iron and steel in the field magnets and the armature core. He showed the derivation of the formulae used, and went through the computations for the design of a motor as an illustration of the principles explained.

PERSONALS

W. W. Atterbury, Mem. Am. Soc. M. E., has been made Fifth Vice-President of the Pennsylvania Railroad. He was formerly General Manager.

John Lord Bacon, Jun. Am. Soc. M. E., has accepted a position with R. P. Shields & Son, San Diego, Cal., as Engineer and Superintendent of Construction. Mr. Bacon is the author of a book recently published, Forging: A Manual of Instruction in Hammering, Working, Forming and Tempering of Iron and Steel.

William A. Baehr, Mem. Am. Soc. M. E., until recently associated with the Laclede Gas Light Co., St. Louis, Mo., as Chief Engineer, has opened a consulting engineering business with an office in the Commercial National Bank Building, Chicago, Ill.

Ervin G. Bailey, Jun. Am. Soc. M. E., formerly Chief of Coal Department of the Arthur D. Little Laboratory, Boston, Mass., has resigned and organized the Fuel Testing Co., 220 Devonshire St., Boston. Associated with him is W. B. Calkins, formerly Chief Chemist of Laclede Gas Light Co., St. Louis, Mo.

C. Kemble Baldwin, Mem. Am. Soc. M. E., is the author of The Belt Conveyor in Railway Building, which appeared in the March 26 number of *The Railroad Age Gazette*.

An article on Tube Tiles used to Form Furnace Roofs, by A. Bement, Mem. Am. Soc. M. E., appeared in the April 6 number of *Power and the Engineer*. Mr. Bement presented a paper on The Illinois Coal Field before the April 7 meeting of the Western Society of Engineers.

Louis Bendit, Assoc. Am. Soc. M. E., formerly Sales Manager of Weber Gas Engine Co., Kansas City, Mo., has recently been appointed by the Buckeye Engine Co., Salem, Ohio, to take charge of their Kansas City office.

J. A. Bennett, Mem. Am. Soc. M. E., of Hartford, Conn., has accepted a position as Mechanical Engineer with the Lodge & Shipley Machine Tool Co., Cincinnati, O.

Prof. L. P. Breckenridge, Vice-President, Am. Soc. M. E., is the author of The Development of the Illinois Experiment Station, which appeared in the April 8 issue of *Engineering News*.

William H. Bryan, Mem. Am. Soc. M. E., delivered an address before the Department of Arts and Sciences of Washington University, St. Louis, Mo., February 12, the subject being The Mechanical Engineer, his Duties, Responsibilities and Opportunities.

W. E. Crane, Mem. Am. Soc. M. E., has contributed an article on Standpipes for a Water Power Supply to the April 6 number of *Power and the Engineer*.

Geo. H. Cushing, Mem. Am. Soc. M. E., is the author of Boiler Firing that Saves Coal, in the April 9 issue of *The Canadian Manufacturer*.

Prof. Wm. F. Durand, Mem. Am. Soc. M. E., has just published the second edition of his book on The Resistance and Propulsion of Ships.

Thomas C. Eayrs, Jun. Am. Soc. M. E., formerly located at Glenbrook, Conn., is now in the employ of the Westinghouse Electric and Manufacturing Co., Cincinnati, O.

Belting Compared with Chain Transmission, presented before the Leather Belting Manufacturers Association, February 1, by Harrington Emerson, Mem. Am. Soc. M. E., was published in the April 6 issue of *Power and the Engineer*. Mr. Emerson addressed the April 5 meeting of the Pittsburg Foundrymen's Association on Modern Productive Relations between Shop Officials and their Subordinates, and The Modern Theory of Profit Sharing.

Prof. R. H. Fernald, Mem. Am. Soc. M. E., of the Case School of Applied Science, delivered a lecture on Producer Gas before the Milwaukee Engineers, Society, March 25.

Fred. B. Franks, Mem. Am. Soc. M. E., recently resigned his position as General Superintendent and Chief Mechanical Engineer of the Bath Portland Cement Co.

Jos. Leon Gobeille, Mem. Am. Soc. M. E., until recently Superintendent of the Pattern Department, Abram Cox Stove Co., Philadelphia, Pa., has become Proprietor of the Gobeille-Harris Pattern Co., Niagara Falls, N. Y.

Harris R. Greene, Assoc. Am. Soc. M. E., formerly with the Parson Mfg. Co., New York, has accepted a position with the Alberger Condenser Co., New York, as Sales Engineer.

Edwin Jos. Haddock, Mem. Am. Soc. M. E., has opened offices in the Schultz Building, Columbus, Ohio, to engage in the general practice of engineering. He was formerly Chief Engineer of the Chain Department of the Jeffrey Mfg. Co., of Columbus.

The name of Sir Robert A. Hadfield, Mem. Am. Soc. M. E., appears in the list of fifteen candidates recommended for election as fellows of the Royal Society for 1909. Sir Robert is expected to visit the United States within the next few weeks.

Robert E. Hall, Mem. Am. Soc. M. E., until recently Secretary of the New York Steam Fitting Co., New York, has become Assistant to the Vice-President of Francis Bros. & Jellet, Inc., Philadelphia, Pa.

Orla K. Harlan, Jun. Am. Soc. M. E., formerly with the Lackawanna Railroad Co., Scranton, Pa., is now in the department of engineering and construction and in the mechanical division, Isthmian Canal Commission, Culebra, Canal Zone, Panama.

Prof. H. Wade Hibbard, Mem. Am. Soc. M. E., presented a paper on Organization, at the April 9 meeting of the St. Louis Railway Club.

George O. Hodge, Jun. Am. Soc. M. E., is now connected with the Bristol Engineering Corporation, Bristol, Conn.

F. W. Hollmann, Jun. Am. Soc. M. E., is the author of An Analysis of Steam and Inertia Forces, which was published in the April 6 issue of *Power and the Engineer*.

J. E. Johnson, Jr., Mem. Am. Soc. M. E., has resigned his position as General Manager of the Princess Furnace Co., Glen Wilton, Va.

Forrest R. Jones, Mem. Am. Soc. M. E., has published a book on The Gas Engine.

Robert R. Keith, Jun. Am. Soc. M. E., recently Superintendent and Assistant Manager for the Light Feed Oil Pump Co., has resigned to accept a position with the A. O. Smith Co. of Milwaukee, Wis., as Assistant Superintendent.

Sidney G. Koon, Jun. Am. Soc. M. E., until recently editor of *International Marine Engineering*, has associated himself with the Jones & Laughlin Steel Co.

Fred. A. Krehbiel, Assoc. Am. Soc. M. E., is no longer associated with the Arnold Co., Chicago, Ill., as Mechanical Engineer. He has accepted a similar position with the Fuel Engineering Co., of Chicago.

Henry A. Lardner, Mem. Am. Soc. M. E., has been made Manager of the branch office of J. G. White & Co., Inc., with an office in the Alaska-Commercial Building, San Francisco, Cal. He was formerly connected with the New York office of this company as General Manager of Engineering.

Paul M. Lincoln, Mem. Am. Soc. M. E., has been elected one of the vice-presidents of the American Institute of Electrical Engineers.

Charles T. Main, Mem. Am. Soc. M. E., has been elected Vice-President of the Boston Society of Civil Engineers.

The second edition of Steam Boilers, by Prof. Edw. F. Miller, Mem. Am. Soc. M. E., and Prof. C. H. Peabody, has just appeared.

Elements of Machine Manufacture, by Fred J. Miller, Manager, Am. Soc. M. E., appeared in the April issue of *Machinery*.

George A. Orrok, Mem. Am. Soc. M. E., Secretary of the Gas Power Section, addressed the members of the Brooklyn Polytechnic Institute, March 6, on the development of the large gas engine in connection with blast furnace operation.

Henry E. Paine, Jun. Am. Soc. M. E., formerly Secretary and Treasurer of the Walter R. Horning Co., has recently become connected with Hughson & Merton, Inc., San Francisco, Cal., and will be in charge of a new department created to handle a number of accounts for Eastern manufacturers of electrical lines.

William N. Parsons, Mem. Am. Soc. M. E., formerly connected with the W. P. Davis Machine Co., Rochester, N. Y., has become Chief Draftsman of the Buffalo Bolt Co., at North Tonawanda, N. Y.

Jos. L. Pitkin, Assoc. Am. Soc. M. E., until recently with the Lane Mills, New Orleans, La., is at present the Southern representative of A. Klipstein & Co., New York, with an office in Atlanta, Ga.

An article on Machine Tools, by L. R. Pomeroy, Assoc. Am. Soc. M. E., was published in the April issue of *The American Engineer and Railroad Journal.*

H. F. J. Porter, Mem. Am. Soc. M. E., has been giving during the winter a course of lectures in the School of Commerce and Finance of New York University. He has also delivered two lectures in the Graduate School of Business Administration at Harvard University. An article by him on The Employer, the Employee and the Community is published in the first number of the new magazine, *Industrial Engineering,* which has just appeared.

Samuel W. Powel, Mem. Am. Soc. M. E., Assistant Mechanical Engineer, American Radiator Co., has been transferred from the Buffalo to the Chicago office.

W. P. Pressinger, Assoc. Am. Soc. M. E., who recently resigned as General Manager of the Compressor Department of the Chicago Pneumatic Tool Co., has organized the W. P. Pressinger Co., to handle vacuum cleaning machines. The new company has opened offices and salesrooms at 1 W. 34th St., New York, and will establish local agencies at all distributing points throughout the Eastern territory.

An article by D. T. Randall, Mem. Am. Soc. M. E., on The Selection of Coal for Boiler Purposes, appeared in the April 6 number of *Power and the Engineer.* This paper was read at the Illinois Coal Conference, held March 10, 11 and 12.

Frederick Ray, Jun. Am. Soc. M. E., has contributed an article on Characteristics of the Turbine Pump to the March 23 issue of *Power and the Engineer.*

The second edition of a Text-book of Mechanical Drawing and Elementary Machine Design, by John S. Reid, Mem. Am. Soc. M. E., and David Reid, has recently been published.

A. G. Robb, Mem. Am. Soc. M. E., has contributed an article on Jigs and Fixtures for Connecting-rod Work to the April 15 issue of *The American Machinist*.

Robert W. Rogers, Jun. Am. Soc. M. E., formerly with Jason Bros., New York, is now with the Pioneer Publishing Co., New York.

Max Rotter, Mem. Am. Soc. M. E., delivered a lecture March 25, on Low-pressure Steam Turbines before the Engineering Society at West Allis, Wis.

David B. Rushmore, Mem. Am. Soc. M. E., addressed the April 2 meeting of the Pittsfield Section of the American Institute of Electrical Engineers on The Use of Electricity in the Steel Mills.

Theodore Stebbins, Mem. Am. Soc. M. E., who has recently resigned as General Manager of the Texas Traction Co., Dallas, was the principal speaker at a meeting and entertainment given last month to ex-President Charles W. Eliot of Harvard University, at the Agricultural and Mechanical College of Texas. The subject of Mr. Stebbins' address was Electric Railways.

William N. Stevens, Jun. Am. Soc. M. E., is no longer associated with Ford Bacon & Davis, New York. He has been appointed Vice-President of the Conveying Machinery Co., New York.

Wilson E. Symons, Mem. Am. Soc. M. E., has been appointed Superintendent of Motive Power and Machinery of the Chicago Great Western. For several years he has been President of the Pioneer Cast Steel Truck Co., Chicago, Ill.

An article on Milling Machine Tests, by Percy V. Vernon, Mem. Am. Soc. M. E., has been published in the March 16 number of *The Engineer*, London.

Charles E. Waddell, Mem. Am. Soc. M. E., will deliver a course of lectures before the Biltmore Forest School, Biltmore, N. C., on the subject of the application of the electric drive to woodworking machinery.

Thos. D. West, Mem. Am. Soc. M. E., has resigned the office of Vice-President and Secretary of the Thos. D. West Foundry Co., Sharpsville, Pa.

C. T. Wilkinson, Jun. Am. Soc. M. E., has contributed an article on The Hydroelectric Plant of the Schenectady Power Co., to the March 27 number of *The Electrical Review and Western Electrician*.

Reginald A. Wright, Mem. Am. Soc. M. E., has entered the service of the Philadelphia & Reading Coal and Iron Co., Pottsville, Pa., in the capacity of Chief Draftsman. Until recently he was associated with the Jenckes Machine Co., Sherbrooke, Que., as Chief Engineer.

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THE SPRING MEETING

The Spring Meeting was held in Washington, D. C., at the New Willard Hotel, May 4-7. The total registration was 609, of whom 276 were members. Fewer professional sessions than usual were arranged by the Meetings Committee in order that visiting members and their guests might avail themselves of the opportunities afforded to inspect places of interest at the national capital.

The Convention opened on Tuesday evening with a reception in the large assembly hall of the New Willard, followed by dancing, with music by the Marine Band. The reception was largely attended and the occasion was a brilliant one. As the guests arrived they were received by the President and Mrs. Smith, Mrs. W. L. Marshall, Mrs. Charles D. Walcott, and Mrs. F. H. Newell.

D. S. Carll, President of the Washington Society of Engineers, called the assembly to order at 9 o'clock, and extended a hearty welcome to the Society on behalf of its local members and of the Washington Society of Engineers. He then introduced Hon. Henry B. F. Macfarland, President of the Board of Commissioners of the District of Columbia.

Speaking on behalf of these same bodies and of the District of Columbia, Mr. Macfarland referred especially to the work of engineers in the city of Washington, and said in part: There is a particularly warm welcome for the Society in the national capital, since engineers more than the men of any other profession have made it what it is. George Washington, in the year of the birth of the Constitution,

conceived the idea of a magnificent capital, then ridiculously out of proportion to the youth, weakness and poverty of the new nation. L'Enfant and Ellicott in the beginning, and a long line of able and brilliant engineers since then, chiefly of the United States Army, have rendered important servce in carrying out his plans. The past nine years, the great municipal building period of the city, have been occupied with such engineering feats as the installation of the filtration plant, the sewage disposal system, the new pumping system, the District government railway terminal work, the District government building on Pennsylvania Avenue and its approaches, the Connecticut Avenue bridge, and others of a similar character. Washington appreciates engineers.

President Smith in responding for the Society extended the thanks of the members for this cordial welcome and their appreciation of the interesting program prepared for their pleasure and entertainment by the committees of the Washington Society of Engineers and of the local members.

RECEPTION COMMITTEE FOR TUESDAY EVENING

The following prominent engineers constituted the reception committee for Tuesday evening:

Lieut. Col. Frederic V. Abbot, Corps of Engrs., U. S. A., Office Ch. of Engrs.; Walter C. Allen, Elec. Engr., Dist. of Columbia; Frank L. Averill, Cons. Engr.; Philander Betts, Asst. Prof. Elec. Engrg., Geo. Washington University; Louis D. Bliss, Pres., Bliss Sch. of Elec.; Rear-Admiral Washington L. Capps, Ch., Bureau Constr. and Repair, Navy Dept.; David S. Carll, V. P. & Gen. Mgr., Capital Traction Co.; Brig. Gen. William Crozier, Ch. of Ordnance, U. S. Army; Arthur P. Davis, Ch. Engr., Reclamation Service; David T. Day, Petroleum Expt., Geolog. Survey; Capt. J. B. Dillard, Ordnance Dept., U. S. Army; Proctor L. Dougherty, Asst. Insp. Elec. Light Plants, Treas. Dept.; Robert Farnham, Jr., Asst. Engr. of Constr., Penna. R. R.; Harry W. Fuller, Gen. Mgr., Washington Ry. and Elec. Co.; Howard L. Hodgkins, Dean, College of Engrg., Geo. Washington University; John C. Hoyt, Asst. Ch. Hydrographer, U. S. Geol. Survey; Ernest N. Janson, Mech. Engr., Navy Dept.; Capt. William Kelly, Corps of Engrs., U. S. A., Asst. to Engrg. Commissioner, D. C., Charles S. Kimball, Engr. Maintenance of Way, Wash. Ry. & Elec. Co.; Marshall O. Leighton, Ch. Hydrographer, U. S. Geol. Survey; Charles A. McKenney, Cons. Engr.; Hon. Robert Shaw Oliver, Asst. Secy. of War; Alfred H. Raynal, Mech. Engr., Navy Dept.; 1st Lieut. William H. Rose, Corps of Engrs., U. S. A.; William E. Schoenborn, Expt. in Pat. Causes; Lindley E. Sinclair, Gen. Supt., Potomac Elec. Power Co.; Charles F. Sponsler, Ch. Engr., Bureau of Standards; Lt. Col. Thomas W. Symons, Advisory Board, Cons. Engr., State Canals, N. Y.; O. H. Tittman, Ch., Coast & Geodetic Survey; Francis R. Weller, Civil and

Hyd. Engr.; Herbert M. Wilson, Ch. Engr., Tech. Branch, U. S. Geolog. Survey; Brig. Gen. James B. Aleshire, Quartermaster Gen., U. S. A.

Business Meeting Wednesday Morning, May 5

The report of the tellers of election was received and there being no objection the President declared the names presented duly elected to membership in the Society. They will be published in The Journal in the usual department for changes in membership.

A report from the Membership Committee was presented which calls for amendments to C 10 and C 11 of the constitution. The first amendment is as follows:

C 10 "An Associate shall be 30 years of age or over. He must have been so connected with some branch of engineering, or science, or the arts, or industries, that the Council will consider him qualified to coöperate with engineers in the advancement of professional knowledge. He need not be an engineer."

The committee recommends the following to be added at the end of C 11 of the constitution.

"A person who is over 30 years of age cannot enter the Society as a Junior."

The report of the Membership Committee published in The Journal for December 1908 gives in full the reasons for desiring the change. The proposed amendments were discussed, and, in accordance with the rules governing the amendments to the constitution, will be presented at the annual meeting for final action, after which they will be sent to the membership for letter ballot.

Prof. Ira H. Woolson, who was a member of the Membership Committee for five years, heartily commended the proposed change and hoped it would become a part of the constitution.

Prof. F. R. Hutton proposed an amendment to C 45, adding "Public Relations Committee" after "House Committee."

RESOLUTION IN REGARD TO THE UNITED STATES PATENT OFFICE

In view of the fact that it has been brought to the notice of the Society that a movement is under consideration to increase and improve the facilities for the work of the United States Patent Office, Prof. F. R. Hutton introduced the following resolution.

Resolved, That this Society in convention assembled requests the Council of the Society to consider the desirability of taking some

action in furtherance of the movement to increase the Patent Office facilities, and, if deemed advisable, that they request the individual members to take steps to urge their influence to this end upon their Senators and Representatives.

The resolution was voted by the meeting.

PROFESSIONAL SESSION, WEDNESDAY MORNING

Four papers were presented at this morning session, two of which related to the conveying of materials. The first was upon A Unique Belt Conveyor, by Ellis C. Soper, of Detroit, Mich., which described an installation consisting of a conveyor one-quarter mile long, so located on an incline that less power is required to operate it empty than when loaded. Data upon performance were given. The second was upon Automatic Feeders for Handling Material in Bulk by C. Kemble Baldwin, of Chicago, Ill. This contained outline drawings and descriptive matter upon different designs of feeders, to enable the engineer to select the type best suited to his needs.

These two papers were discussed by William T. Donnelly, William A. Bole, T. A. Bennett, Harrington Emerson, Fred J. Miller, Geo. Dinkel, W. E. Snyder, E. J. Baufield.

The third paper was upon A New Transmission Dynamometer, by Prof. Wm. H. Kenerson of Providence, R. I. This is made in the form of a shaft coupling. The apparatus contains an oil chamber, one side of which is a diaphragm, and it is so arranged that pressure is brought against this diaphragm directly proportional to the amount of power transmitted. A gage or other registering apparatus is connected with the oil chamber by a small tube which indicates the pressure and the water power transmitted. Discussion was offered by A. F. Masury.

The last paper was upon Polishing Metals for Examination with the Microscope by Albert Kingsbury, Pittsburg, Pa., in which he described the use of a polishing machine carrying discs faced with common paraffin and charged with wet abrasives. This produces excellent surfaces on all the harder metals and alloys, but has not proved serviceable upon the soft metals, such as lead.

Wednesday Evening Lecture

On Wednesday evening Frederick H. Newell, director of the Reclamation Service, was to have lectured on Home Making in the Arid Regions. As he could not be present a lecture on this subject was

given instead by Arthur P. Davis, Chief-Engineer of the Reclamation Service.

The United States Reclamation Service in its seven years of existence has undertaken 26 projects situated in 16 different states and territories of the West. It has invested in construction about $40,000,000. Nineteen projects have been brought to a point where some land is now under irrigation. Water is ready for delivery to about half a million acres. An average of about 10,000 laborers is employed on this work, and over 55,000,000 cu. yd. of rock and earth have been excavated. Over 2000 miles of canals have been built and 56 tunnels have been bored, which have a total length of over 13 miles.

Twelve large earthern dams, and one high masonry dam have been completed, and two other masonry dams, which will rank among the highest dams in the world are in an advanced stage of construction. Many of these projects are in remote localities into which roads had to be built, some of which were carved in precipitous rock, or tunnelled through mountains. In the aggregate 342 miles of roads and 793 bridges have been constructed.

In some localities, especially on the Pacific slope, the mild climate, and the nearly perpetual sunshine, produce remarkable results in the growth of fruits, which for color, flavor and physical perfection cannot be equaled in a more humid climate. The chemical force in sunshine and a perfectly regulated water supply are also evident in the yields of vegetables and forage crops.

The lecture was illustrated by many beautiful slides.

Gas Power Section

At this session, F. R. Low, Chairman of the Gas Power Section presided, and Geo. A. Orrok acted as Secretary. Previous to the reading of the professional papers were reports from the committees.

Membership Committee: The report showed a total membership of 302, of which 177 were members of The American Society of Mechanical Engineers and 125 were affiliates. The Membership Committee is thoroughly organized with representatives in different cities.

Literature Committee: Prof. C. H. Benjamin gave a verbal report of this committee stating that the committee is organized for work and had laid out a tentative program. It was hoped to index the books on the subject of gas power and articles in periodi-

cals dealing with gas power and allied subjects; also to present reviews of new books and abstracts of important articles. There would be two fields for work: one, a prominent one, and the other in the line of current work relating to popular reviews and abstracts for the benefit of members.

Plant Operations Committee: A verbal report was offered by Irving E. Moultrop reporting progress and that standard forms for obtaining operating data on gas power plants were in preparation. The committee has a large membership and is widely scattered so that it had been impossible to arrange a meeting, but the work had been advanced as far as possible by correspondence.

Reports of other committees will be offered later.

Mr. Orrok stated with reference to the work of committees that it is conducted with the idea that as the Gas Power Section has been formed while the art is young it will be possible to place a record of its development on file to keep at the headquarters of the Society. Such data in connection with the large library will place at the disposal of anyone interested in the industry the available information upon the subject of gas power.

Following the presentation of the reports came the professional papers, the first of which was on Marine Producer Gas Power, by C. L. Straub of New York. This paper explained the conditions opposing the earlier adoption of producer gas power for marine service and gave a summary of marine gas power plants in operation at present. It compared the updraft and downdraft of producer gas apparatus and contained comparative drawings of the steam equipment and two types of producer gas equipment for a 306 ft. boat. Discussion was offered by the following: J. A. Holmes, George Dinkel, Henry Penton, Irving E. Moultrop, Herbert M. Wilson, E. T. Adams.

The next paper was upon The Operation of a Small Producer Gas Power Plant, by C. W. Obert of New York. It presented a general description of a producer gas power plant in the Westchester market building of Swift & Company, Bronx Borough, New York. The author outlined the operating and maintenance system developed for keeping producers and engines in proper condition for continuous operation. This paper was discussed by: J. A. Holmes, John H. Norris, Wm. A. Bole, Henry R. Gobleigh.

A paper was presented upon A Method of Improving the Efficiency of Gas Engines, by Thomas E. Butterfield of Philadelphia, Pa. It related to the securing of higher efficiency by reducing the clearance

and increasing the compression and referred especially to a method of diluting with an inert gas the charge drawn in during the suction stroke of an Otto cycle engine. By this means premature ignition and other troubles incident to high compression are avoided. Discussion followed by A. M. Greene, Jr., and W. O. Barnes.

The last paper of the session was upon Offsetting Cylinders in Single-Acting Engines by Prof. T. M. Phetteplace of Providence, R. I. It gave the results of an investigation of this subject in which the various factors entering into the problem were taken into account. Discussion was contributed by Winslow H. Herschel and John H. Norris.

Presentation of Portrait of Rear-Admiral Melville

On Thursday evening was the presentation to the National Gallery of a portrait of Rear-Admiral Geo. W. Melville with addresses given in the auditorium of the New Willard. President Smith presided and a large audience assembled for the ceremony and was addressed by Rear-Admiral Melville on The Engineer in the Navy. Mr. Walter M. McFarland of Pittsburg, Pa., gave an appreciation of Melville as a man and of his work for the nation and the profession. The portrait was accepted with appropriate remarks by Dr. Chas. D. Walcott, Secretary of the Smithsonian Institution.

At the conclusion of the ceremony, President Smith appropriately asked that Mr. Sigismond de Ivanowski, the Russian artist who had produced so admirable a likeness of Melville, be escorted to the platform. This noted artist briefly and simply told of his attempt to portray the strong characteristics of his subject and displayed evident pleasure that his efforts were so warmly appreciated.

Professional Session, Friday Morning

Five papers, and a continuation of the Safety Valve discussion given at the February meeting in New York, were scheduled for this session. The first paper was upon Small Steam Turbines by Geo. A. Orrok of New York. The various types of turbines now on the market were illustrated and described and a number of steam consumption curves were given to demonstrate the economy that might be expected from machines of this type. Discussion was offered by the following: Charles B. Rearick, Charles A. Howard, Prof. R. C. Carpenter, W. D. Forbes, R. H. Rice, Harry Y. Haden, Fred. D. Herbert, W. E. Snyder. William T. Donnelly, F. H. Ball.

A paper on Compressed Air Pumping Systems of Oil Wells by Edmund M. Ivens of New Orleans, La., was read, in which a description was given of compressed air plants at Evangeline, La., oil fields, and the results of tests upon these plants with different types of apparatus. Discussion by: F. A. Halsey, Chas. E. Joubert, Sanford A. Moss, and J. E. Callan.

Following this was the Safety Valve discussion in which the following participated: F. L. Pryor, E. F. Miller, Geo. H. Musgrave, A. B. Carhart, Sidney B. Paine, M. W. Sewall, Albert C. Ashton, A. F. Nagle, Jerome J. Aull, A. J. Hewlings, F. M. Whyte, P. G. Darling.

Two papers followed upon the properties of steam; one by Prof. C. H. Peabody, of Boston, Mass., on Specific Volume of Saturated Steam, and the other upon Some Properties of Steam by Prof. R. C. H. Heck of New Brunswick, N. J. The former reviewed the results of experiments which might form the basis of a computation of specific volumes at various temperatures and compared the computed results with experimental determinations of the same quantities. The latter paper summarized the important work of Holborn and Henning and compared the results of other investigators. These two papers constituted another step ahead in the work that is now being accomplished toward securing accurate information upon the properties of both saturated and superheated steam. Discussion was offered by: Prof. Wm. D. Ennis, Sanford A. Moss.

The last paper was by H. V. Wille, Philadelphia, Pa., on A New Departure in Flexible Staybolts. This paper proposed the employment of tempered spring steel in the manufacture of the stems of staybolts, the ends being of soft steel so as to permit riveting over in the boiler. Discussion by: Wm. Elmer, W. E. Hall, Alfred Lovell.

This, the last session of the meeting, closed with the passing, unanimously, of a resolution extending the thanks of the Society to those who had afforded so abundant entertainment to their visitors. The text of the resolution is as follows:

RESOLUTION OF THANKS

Whereas The American Society of Mechanical Engineers in convention assembled at Washington, May 4–7, 1909, desires to express its appreciation of the hospitality extended to its visiting members and friends by its hosts, and to all who by untiring efforts have made the Spring Meeting of 1909 so extraordinarily pleasant and profitable an occasion,

Be it Resolved That the Secretary be instructed to extend the thanks of the Society and to express the profound appreciation of its members and guests for the hospitality extended and the entertainment afforded through-

out the convention by the Washington Society of Engineers, by Mr. Walter Ashfield McFarland, Chairman of the Local Committee, by the Local Committee itself; and to the members of the Reception Committee for Tuesday evening.

Special thanks are tendered the Chairman of the Ladies' Committee, Mrs. James Loring Lusk, and the members of that Committee for their cordial entertainment of the visiting ladies, and for their share in the social events of the meeting.

The visiting members extend thanks to the President, Mr. Taft, for his reception of members and guests at the White House; to the Secretary of War, Mr. J. M. Dickinson, for the exhibition drill of troops at Fort Myer; to Mr. Davis for his lecture on Home-Making in the Arid Regions; to Rear-Admiral Melville for his address on The Engineer in the Navy; to the University Club of Washington for the use of its club rooms; to the Columbia Golf Club; and to the Western Union Telegraph Company for sending messages free of charge.

The Secretary is authorized to extend this vote of thanks to all others from whom courtesies were received, including those in charge of the public and private works which were thrown open to the members for inspection.

Entertainment

During the entire convention an information bureau was conducted at the Society headquarters by Chairman Walter A. McFarland of the Local Committee, where the various excursions were organized. These not only included trips to the public buildings, but to government institutions and other points of technical interest, among which were the Bureau of Standards, the station of the Potomac Electric Power Co., the Union Railway Terminal, the Naval Gun Factory, the District pumping stations, etc.

At the ladies' headquarters in the New Willard, tea was served each day from four to six o'clock and the visiting ladies as well as many members of the Society, accepted the hospitality extended by the ladies at this time. Sight-seeing automobile trips for the ladies were also arranged on each day, which were largely patronized and greatly enjoyed.

On Wednesday afternoon was the excursion to Fort Myer to witness the exhibition drill. A large number attended this outing and the evolutions performed by the several troops and the unusual skill of both riders and drivers and the thoroughly trained horses, called forth round after round of applause. Two battalions of artillery with guns and caissons went through evolutions of great complexity. Two troops of cavalry went through various formations, apparently equally as difficult, and a troop of bare-back riders displayed horsemanship that captivated the audience.

On Thursday afternoon the reception of members and guests by President Taft in the East room of the White House was very generally attended.

On Friday afternoon following the professional session, many went by boat to Mt. Vernon to visit the beautiful estate and home of Washington. A wreath from the Society was placed by Washington's tomb, the members grouping themselves about the entrance as this was done in recognition of the memory of the first president of our country.

It was planned to go by train from Mt. Vernon to Fort Myer to witness the ascension of the dirigible balloon located there, which had been filled and otherwise prepared for a trip to be made on this occasion. Rainy weather, however, made it impossible to give this exhibition and most of the company returned directly to the New Willard.

MEETING OF MEMBERS AND OTHER ENGINEERS IN BOSTON

A meeting was held in Boston, April 16, 1909, to discuss the advisability of holding meetings of the Society in that city. The President and the Secretary of the Society attended, and there were present about 160 members and guests. Irving E. Moultrop, Manager of the Society, was elected temporary chairman, and Ralph E. Curtis, temporary secretary of the meeting.

ADDRESS BY THE PRESIDENT

Mr. Smith made an address in which he gave assurance that the Society is deeply interested in any movement tending to bring engineers closer together for their general and individual good. He spoke of the recent action of the Council authorizing the Meetings Committee to arrange for meetings in various places upon the same basis as meetings are now held in New York, and said that it is the desire of the officers of the Society that these meetings shall be as free and open as is consistent with the traditions and high professional standards which the Society has maintained during its thirty years' experience. To that end specific rules for their government have not been laid down. The Council and Meetings Committee are disposed to meet this question in the most liberal manner.

Mr. Smith placed the emphasis on the holding of meetings of the Society in different cities rather than forming sections or branches; also on the advantage to members of presenting papers before the meetings on such a basis, and their publication in the Journal, in advance, when accepted, making it possible to have them discussed in all the cities where meetings are held. He advocated the maintenance of the solidarity of the membership of The American Society of Mechanical Engineers, rather than encouraging its division into sections. He thought Boston an ideal place in which to inaugurate this new movement, on account of the large number of members of the Society in that vicinity, there being about 335. Mr. Smith further emphasized the friendly spirit of coöperation of the Society toward other engineering societies; saying also that engineers are welcome at meetings whether or not they are members of any

society. He mentioned as being held in particular esteem the Boston Society of Civil Engineers and said that The American Society of Mechanical Engineers desires to work in coöperation with that society.

ADDRESS BY THE SECRETARY

Mr. Rice said that the call for this meeting, addressed to all interested in mechanical engineering, is typical of all professional meetings of The American Society of Mechanical Engineers. Wherever a meeting of the Society is held, anyone interested in engineering is welcome. He endorsed all that President Smith had said, and added that the opportunity of coming together for an exchange of experiences and views is essential to the life and growth of any society. He said that it has become evident that two conventions a year are not sufficient for a national society and it is further evident that the holding of meetings more frequently in one place does not create a national spirit.

In regard to the formation of separate societies, the Secretary said: When the first engineering societies were formed there were not so many prominent specialties as at present, so they constituted themselves civil engineers, that is, all engineers not military. Later, when engineers began to specialize, separate societies were formed, so that we now have four large national engineering societies, and many others, national and local. He emphasized the main idea of providing meetings of the profession rather than multiplying societies. He thought that while there is still necessity for specializing, it could be obtained within the societies already formed without the duplication of organization and expense.

Mr. Rice said that the question before the meeting was, how can the engineering profession in Boston and vicinity best get together for common and individual good, and stated that The American Society of Mechanical Engineers desires to do what will best serve the profession. He expressed the hope that that would be accomplished by bringing together the various organizations in a common headquarters rather than by the formation of a new organization. One of the important advantages of such a course is economy. The Society will bear the essential costs, such as sending out notices, cost of hall, printing, stenographer, etc. In answer to a question in regard to the participation of the students, the Secretary replied: By all means include them, and make them welcome at all your meetings.

Mr. Rice quoted from Sir Thomas Telford's address, upon taking office as the first President of the Institution of Civil Engineers: "Judicious regulations are absolutely necessary to all societies, but I trust that in this the good sense of the members will always prove that manners and moral feeling are superior to written laws." He closed by declaring that coöperation and coördination should be the motto of the profession.

GENERAL DISCUSSION

Mr. Moultrop agreed with the Secretary that there are already too many societies and that it would be both better and cheaper to have local meetings of national societies. He spoke specially of the advantages of personally meeting other local engineers.

Henry Bartlett moved that the members of The American Society of Mechanical Engineers of Boston and vicinity hold local meetings and that a committee of arrangements get into communication with the Meetings Committee of the Society. The motion was seconded and passed.

Mr. Bryant, Vice-President of the Boston Society of Engineers, although he declared that he was not speaking officially, felt certain that local meetings of The American Society of Mechanical Engineers in Boston could count upon the coöperation of the Boston Society of Civil Engineers.

James D. Andrew moved that the present committee of the Boston Society of Civil Engineers, composed of Messrs. Hollis, Miller, Main, Libbey and Moultrop, being also members of The American Society of Mechanical Engineers, be appointed to conduct the proposed meetings. The motion was unanimously adopted.

Fred R. Low, Chairman of the Gas Power Section, spoke favoring the scheme of monthly meetings as being freer in discussion and affording an opportunity for engineers to meet each other personally.

Paul Winsor, Superintendent of Motive Power and Machinery of the Boston Elevated Railroad, expressed his interest in the formation of an organization in Boston.

Prof. W. W. Bird said that the Worcester Polytechnic would do everything possible to help local meetings in Boston.

Prof. Geo. F. Swain expressed his pleasure in the plan of holding meetings in Boston as a means of improving the standing of the profession and of making the profession a force in the community.

Prof. L. S. Marks thought there could be no doubt about the

desirability of having local meetings, and heartily approved of the broad lines on which the organization is being formed, which welcomes engineers of all grades of experience. He said that the students would be greatly stimulated by the opportunities, and their interest and enthusiasm may help the older members.

Prof. D. C. Jackson said he was certain, from his experience in the Western Society of Engineers in Chicago, that meetings of a national society only strengthen the local societies.

Prof. Gardner C. Anthony said he would welcome most heartily any such organization as this, as a means of promoting the personal acquaintance of members. He also spoke of the influence of students and the desirability of interesting them while they are in college. He said that Tufts College would coöperate to promote the interests of the Society wherever possible.

Francis W. Dean suggested that members in Boston would have to write papers, in order to keep the meetings alive.

E. G. Bailey spoke in favor of securing practical papers, as opposed to theoretical, and favored the scrutiny of the papers to be presented, by some committee capable of deciding what would be interesting to members in Boston.

Professor Lanza spoke briefly saying that there are enough mechanical engineers in Boston to keep the meetings alive if they keep the proper stimulus. He thought there would be no interference between the Boston Society of Civil Engineers and the meetings of The American Society of Mechanical Engineers.

COMMUNICATION FROM THE CHAIRMAN OF THE MEETINGS COMMITTEE

The attention of the members of the Society is especially called to a resolution that was recently passed by the Meetings Committee and approved, with slight modifications, by the Council, as follows:

Resolved: That the Meetings Committee may, subject to the approval of the Council, arrange, authorize and discontinue, as in the judgment of the Meetings Committee may be for the best interests of the Society, with members of the Society residing in places other than New York, for the holding of meetings in such places, as is now done monthly in New York, for the presentation and discussion of such papers as may have been previously accepted by the Meetings Committee. The proceedings of such meetings to be reported stenographically, transcribed and sent promptly to the Meetings Committee. The expenses of such meetings to be defrayed by the Society on a basis prearranged with the Meetings Committee; such expenses to be under the control of the Executive Committee of the Council for approval in general, before such expenses are incurred.

The monthly meetings of the Society that have, for the past few years, been held in New York, have been very successful. They are usually informal and there is sufficient time to permit of a thorough discussion of the papers submitted by the members present. This feature has been so pronounced that the Meetings Committee has recognized the desirability, for this and other reasons, of reducing the number of papers assigned to the professioual sessions at the Spring and Annual Meetings to permit of their more thorough discussion.

Previous to the adoption of the above resolution, monthly meetings of the Society at the headquarters in New York were the only ones authorized by the Council. But with an association extending over so large a geographical area as that covered by The American Society of Mechanical Engineers, the accessibility, and therefore the attendance at the meetings, has been practically restricted to those members residing in or adjacent to New York, which area contains less than 23 per cent of the total membership of the Society.

It was, therefore, with the object of extending this privilege, in so far as the funds of the Society will permit, that the aforesaid resolution of the Meetings Committee was presented.

The resolution carries with it the distinct understanding that such meetings, wheresoever held, are meetings of the Society and not of branches nor sections. They are to be conducted under the same privileges and restrictions, no more and no less, than those governing the meetings held in New York. It is not essential that such meetings be held monthly. The number of meetings to be held during a season would depend on local conditions, and to this end the Council and Meetings Committee would be more or less guided by the recommendation of the local members.

The sentiment that prompted the resolution was that geographical location of membership was a mere incident, and in view of the success of the monthly meetings held in New York there is no reason why the same opportunity should not be extended to all localities where the number of members adjacent thereto would warrant. With the object of meeting any and all local conditions that may arise, the resolution was made broad and liberal.

By reference to the Constitutio and By-Laws of the Society it will be seen that the restrictions placed upon the conduct of such meetings as are covered by the resolution are exactly the same as those governing all meetings of the Society. These rules of procedure are the outgrowth of many years of experience, and are only such as have been found necessary to safeguard the high professional standing and traditions of the Society. Their enforcement is under the guidance of officers selected from and representing the Society at large.

From the scope of the resolution it will, therefore, be seen that the opportunity to hold meetings in any locality is extended to the members therein, but that it is not intended that such meetings must necessarily be held monthly; nor even simultaneously with those held in New York; nor that the same papers be necessarily discussed at all the meetings. No further organization is required than a Chairman and Secretary selected from among the local members. They will request the Meetings Committee of the Society to hold meetings, stating at the time the number of meetings that it is considered can be advantageously held during a season, and give an estimate of the cost of such meetings. The movement is not intended to conflict with any local engineering association that may exist, but, on the contrary, to coöperate with such organization by extending invitations to its members to attend the meetings of the Society, and in any other way consistent with the rules of the Society. No doubt cases will arise, when the Meetings Com-

mittee will be ready to delegate to two or more local members authority to act relative to the acceptance of papers submitted for presentation at the meeting.

It is the desire and wish of the officers and the Meetings Committee to assist the members of any locality in the organization and conduct of any meetings they may wish to hold. To this end, any members desiring meetings should unhesitatingly communicate with the Secretary relative to any doubtful features that may have arisen.

The movement inaugurated by the resolution should be of great benefit to the members. It should bring out much excellent material that is now dormant and add much valuable discussion, the best of our contributions, for use in The Journal and the Transactions. It permits the simultaneous consideration of the same paper at two or more points, and doubtless there would be occasions when the Meetings Committee would wish to have simultaneous discussion of papers that may have been arranged to be presented at some other meeting place.

It is believed that the spirit of the resolution carried out in its entirety will bring the members more closely together, both professionally and socially, than any movement that has ever been inaugurated, and in that way give the Society an impetus for much and lasting good.

REPORT OF ADVISORY COMMITTEE ON FUELS AND STRUCTURAL MATERIALS

The representatives of the Society on the Government Advisory Board on Fuels and Structural Materials presented a report to the Council at its meeting, May 4, concerning the work of the board. An abstract is here given and the complete report is on file in the Secretary's office, where it may be consulted.

ABSTRACT

Congress made provision in 1905 "for analyzing and testing at the Louisiana Purchase Exposition the coals and lignites of the United States, in order to determine their fuel value and the most economic methods for their utilization for different purposes, under the supervision of the Director of the U. S. Geological Survey." For this work $60,000 was appropriated.

It was provided that all testing machinery and all coals and lignites tested should be contributed without charge to the Government. The Director of the Survey appointed a committee of three from his staff to have charge of the work, and they, in turn, appointed experts, in several cases members of The American Society of Mechanical Engineers, each one of whom was given charge of some specific phase of the whole work.

The conditions incident to a great exposition were not favorable for scientific work, but the value of the results accomplished is indicated by the reports issued upon field work, the classification of coals, chemical analysis of fuels, and investigations concerning producer gas, coking, briquetting and the washing of fuels.

Later, Congress made appropriations for continuing the work another year. At this time the President of the United States requested a number of civilian engineers, representing prominent societies, among which was The American Society of Mechanical Engineers, to form a board to assist the Government in an advisory capacity in the work of testing fuels and structural materials.

Organization was effected at the first meeting of the advisory board and there have been two subsequent meetings, one at James-

town in 1907, and the other in Pillsbury in 1908. Committees of the full board have held meetings at various times for the discussion of special problems. In all that has been done, the representatives of The American Society of Mechanical Engineers have had their full share.

For the fiscal years ending June, 1907 and 1908, Congress made specific appropriations for testing fuels and for testing structural materials. For 1908 the sum of $250,000 was appropriated for fuels and $100,000 for structural materials. For the year ending June 1909, a smaller appropriation was made for fuels and structural materials and one of $125,000 was added for investigations of mine explosions. The work in testing structural materials has been differentiated. In the fuel investigations coals from hundreds of mines have been analyzed, subjected to calorimeter tests, tested under boilers, tested in gas producers, and sometimes tested to determine their coking properties.

A study of mine wastes and of problems involved in the utilization of inferior grades of coal has been going on continuously, and the value of the briquetting process as applied to the lignite beds and to the fine coals and older coal fields has received due attention.

Attention is now being given to the fundamental problem of combustion, to the study of flameways, and to the temperature and composition of gases therein, and to the effect of baffling upon the room required by flames for satisfactory combustion; all as developed from typical fuels. The investigations concerning mine explosions have been demonstrative rather than investigational and have been of great importance. As a result of work along these several lines, 30 articles have been published or are being prepared. Laboratories have been established at Pittsburg which promise to be permanent. A bill is now before Congress authorizing the establishment of a Bureau of Mines which is designed to give the work of testing fuels and structural materials a more substantial organic setting and to insure it permanent means of support.

MEETING OF THE COUNCIL

At the meeting of the Council, May 4, 1909, there were present Messrs. Bond, Gantt, Hunt, Hutton, Miller, Smith, Swasey, Wiley, the Secretary and J. W. Lieb, Chairman of the Library Committee.

The appointment of the Nominating Committee was announced: Worcester R. Warner, Cleveland, *Chairman;* Walter M. McFarland, Pittsburg; Morgan Brooks, Urbana, Ill.; David Townsend, Philadelphia; Francis W. Dean, Boston.

The appointment of the Committee on Power Tests was announced: Edward T. Adams, Geo. H. Barrus, L. P. Breckenridge, D. S. Jacobus, William Kent, Chas. E. Lucke, Edw. F. Miller, Arthur West, Albert C. Wood.

Voted: To receive and place on file the report to the Council by W. F. M. Goss, George H. Barrus and P. W. Gates, members of the Government Advisory Board on Fuels and Structural Materials, U. S. Geological Survey.

Voted: To print an abstract in The Journal and to state in the abstract, that the full report is on file in the office of the Secretary for consultation by the membership.

Voted: To approve the report of April 13 of the Executive Committee, acting as a Committee on Standards.

The Meetings Committee reported that a meeting of mechanical engineers residing near Boston was held April 13, and a similar meeting of the members in St. Louis, April 10. The President and the Secretary addressed the meeting in Boston.

The committee of arrangements appointed by the Boston Society of Civil Engineers, who are also members of this Society, is as follows: Ira N. Hollis, *Chairman;* Joseph H. Libbey, Charles T. Main, Edward F. Miller, Irving E. Moultrop. These gentlemen were again appointed by the meeting itself as a committee of arrangements for future meetings of the Society in Boston.

The Library Committee reported that they had received the action of the Board of Trustees of the United Engineering Society, on the report of the Joint Library Conference Committee, covering the future policy of the Library with respect to:

a Gifts intended for the Library in its broad and general sense, as distinguished from gifts to the Library of one of the Founder Societies.

b An associate society which may desire to have its library in whole or in part placed in the Library for public use, under the general control of the Library administration as a whole.

c Re-arrangement of the libraries of the three Founder Societies to bring them under one numerical arrangement.

d The formation of a United Engineering Society Library.

With respect to the foregoing items the Committee recommends as follows:

a, b That we receive the libraries of associate societies, provided the books are permanently left with the Library.

c That the libraries of the three founder societies be adjusted to bring them under one numerical arrangement.

d That the United Engineering Society Library be instituted, in which this Society shall have joint ownership with the other Founder Societies.

Voted: To approve the recommendations of the Library Committee.

Voted: To authorize the Library Committee to solicit donations for the above library.

Voted: That as a general policy library privileges be exchanged with sister societies and similar institutions; and it was specifically

Voted: To exchange library privileges with Columbia University in response to their request and the recommendation of the Library Committee of the Society.

Voted: That the list of all accessions to the libraries of each of the Founder Societies and of the United Engineering Society be published regularly in The Journal.

The report of the Publication Committee was received and the Secretary directed to advise that committee of the previous action of the Council with respect to the disposition of the income derived from advertising.

The report of the House Committee was received, stating that they had let the contract for partitions and sliding doors, and for the tinting of walls and rugs for three rooms, and for furniture for the hall.

The Council approved the action of the Finance Committee agreeing to an appropriation of $500 for increase of membership, the expenditure to be deferred until later in the fiscal year.

The Secretary read communications from the Chairman of the United States Delegation to the Pan-American Scientific Congress in which it was voted that the delegation officially bring to the attention of the learned societies of national scope in the United States the desirability of inviting the scholars and investigators of Latin America to coöperate with them.

Voted: To refer the above matter to Messrs. Hunt, Hutton and Miller for consideration and report.

GENERAL NOTES

MEETING OF THE SOCIETY IN BOSTON, JUNE 11

A meeting of the Society will be held in Boston, June 11, at 8 p. m., in the Lowell Building of the Massachusetts Institute of Technology.

The meeting is called for the reading and discussion of the paper on Small Steam Turbines, presented by Geo. A. Orrok at the Washington meeting. The manufacturers of small turbines have been invited to attend. The meeting is open to all interested in engineering and students are specially welcome.

This meeting is in harmony with the new policy of holding meetings of the Society in different cities, which the Chairman of the Meetings Committee, W. E. Hall, describes in this issue. The papers published in The Journal will be more widely discussed when coming up before meetings in different parts of the country and the readers of The Journal at large will receive the benefit.

THE STEVENS INSTITUTE BRANCH

The Stevens Engineering Society, affiliated with The American Society of Mechanical Engineers, listened to an account of extensive visits to various automobile factories, from Prof. F. De R. Furman, Professor of Kinetics and Machine Design, on March 4. A week later, Prof. L. A. Martin, head of the Mechanics Department gave a lecture on Centripetal and Centrifugal Force. He dwelt particularly on D'Alembert's principle and its applications, and explained the need for flexible shafts in high-speed turbines. On March 18 a lecture on Conservation was delivered by H. S. Putnam, who, was one of the speakers at the National Conference of Governors. The subject of Aëronautics has been taken up by the Branch, and on March 23, Messrs. Armstrong, '09, and Upson, '10, told of their experiments with aëroplanes. The Branch visited the Morris Park racetrack to witness some demonstrations of flight by M. Triaca, of the New York Aëronautic Society. Several new members have been received.

A lecture on Wireless Telegraphy was given by Fred. K. Vreeland, of the Electrical Testing Laboratories, New York, on April 15. He explained the elementary principles of wireless telegraphy, and made some interesting experiments.

Dr. Geo. V. Wendell, of the Institute, delivered a lecture, April 22, on Radiation and Optical Pyrometry, in which he, explained the "black body," and the different classes into which ether-vibrations are divided. An inspection trip was made to plants in Newark. The following officers for the year were elected: H. H. Haynes, President, J. S. Ware, Vice-President; R. H. Upson, Secretary; E. T. P. Greenidge, Treasurer.

STUDENT BRANCH AT LELAND STANFORD

The mechanical engineering students of Leland Stanford University have organized a student branch of The American Society of Mechanical Engineers under the name of the Stanford Mechanical Engineering Association. Its object is to further an interest in professional work and to promote good fellowship among its members.

The branch has organized with three classes of members, active, associate, and honorary. Active members may consist of juniors, seniors, graduates and others. Juniors, seniors and graduate students may be elected to membership by a ¾ vote of the association; sophomores may be elected by unanimous vote of the active membership. Honorary and associate members are exempt from dues. The student officers shall consist of a chairman, a vice-chairman and a secretary-treasurer. The honorary chairman shall be ex-officio a member of the governing committee.

The Section has elected Professor W. F. Durand, Mem. Am. Soc. M. E., Honorary Chairman, P. H. Van Elton, Chairman, A. C. Coonvadt, Vice-Chairman, and Henry L. Hess, Secretary and Treasurer.

ACTIVITIES OF THE STUDENT BRANCH AT PURDUE UNIVERSITY

The Mechanical Engineering Society of Purdue University, affiliated with The American Society of Mechanical Engineers, held a meeting at the University, Lafayette, Ind., April 14. The meeting was addressed by L. V. Ludy, Mem. Am. Soc. M. E., Professor of Mechanical Engineering of the University. The subject of his address was Laboratory Tests of Automobiles.

At the meeting of the Branch April 26, Theodore Weinshank, Mem. Am. Soc. M. E., of Indianapolis, delivered a lecture on the

Heating of Feed Water for Boiler Purposes. It was illustrated by lantern slides, showing various heaters and purifiers.

THE PURDUE UNIVERSITY BRANCH

The Purdue Mechanical Engineering Society, affiliated with The American Society of Mechanical Engineers, held the final meeting of the year on May 5, at which the following officers were elected for the first semester of next year: E. T. Kirk, President; T. J. Kelley, Vice-President; W. P. Dornes, Recording Secretary; J. R. Jackson, Corresponding Secretary; Members of the Governing Board: L. V. Ludy, Honorary Chairman, C. O. Witt, C. O. Luhn.

UNION CATALOGUE FOR THE LIBRARY

The work of making a union catalogue of the books in the three libraries comprising the Library of the Engineering Societies was begun September 1, 1908. A card catalogue of subjects was completed early in May and the card catalogue of authors will soon be finished. By this combined catalogue, which is placed in a handsome cabinet recently purchased by the Library Committee, the resources of the Library will be made much more readily available to patrons.

In addition to this catalogue, an index to the contents of all current technical publications in the library will be kept on file. The trade catalogues have also been indexed by subjects and firms. The catalogues are kept in a vertical file attached to the cataloging cabinet, and are readily accessible to all persons using the library.

Another convenience recently added to the library is an alphabetical list, which has been printed and framed, of all current periodicals on the shelves.

HONORARY VICE-PRESIDENTS OF THE SOCIETY

The President, Jesse M. Smith, of New York, will represent the Society at the commencement exercises at Columbia University.

Worcester R. Warner, Mem. Am. Soc. M. E., and Calvin W. Rice, Secretary Am. Soc. M. E., are appointed honorary vice-presidents to represent the Society at the inauguration of Richard Cockburn Maclaurin, M.A., LL.D., Sc.D., as President of the Massachusetts Institute of Technology.

ARTICLE ON THE PANAMA CANAL BY PAST-PRESIDENT JOHN R. FREEMAN

John R. Freeman, Past-President, Am. Soc. M. E., who accompanied Mr. Taft to Panama as one of the board of advisory engineers appointed by President Roosevelt, has contributed an article to the *Outlook* (April 24) on The Problem of the Panama Canal. An editorial in the *Outlook* of this issue says of Mr. Freeman:

Mr. John R. Freeman is one of the most distinguished of contemporary hydraulic engineers. He is a graduate of the Massachusetts Institute of Technology, and has been engaged in many great water-power enterprises, both private and public. He has been a consulting engineer to the Panama Canal Commission and to the Board of Water Supply which is building the great Catskill Aqueduct. The opinion of no engineer in this country will be treated with greater respect on the question of canal locks and dams, by professional colleagues, than that of Mr. Freeman. He was one of the special board appointed by Mr. Roosevelt last winter to visit Panama and report on the stability of the Gatun Dam.

TECHNOLOGY DINNER TO PROFESSOR SWAIN

Former students of the Massachusetts Institute of Technology joined in a complimentary dinner to Professor George F. Swain, Mem. Am. Soc. M. E., at Boston, on the evening of April 30. Professor Swain, who leaves the Institute shortly to become Professor of Civil Engineering at the new Graduate School of Applied Science at Harvard University, has been on the faculty of the Institute continuously for 28 years, beginning in 1881 as instructor. In that time he has earned, to an unusual degree, the esteem and affection of all who studied under him, and the dinner was an expression of this appreciation. Some seventy-five men gathered around the tables.

Addresses by prominent graduates of the Institute told of the sentiments of Professor Swain's fellow-students and pupils toward him. The speakers included: the toastmaster, J. Waldo Smith, Mem. Am. Soc. M. E.; Charles A. Stone; Prof. Alfred E. Burton; Chas. T. Main, Mem. Am. Soc. M. E.; Geo. W. Kittredge; Prof. Wm. Z. Ripley of Harvard University; Prof. Chas. M. Spofford, who is to succeed Professor Swain at the Institute; Frank L. Locke; and Professor Swain.

UNIVERSITY OF UTAH

The State School of Mines at the University of Utah has installed a road-testing laboratory as a part of the regular testing laboratory

in the department of mechanical engineering. The latest bulletin from the school, which was prepared by E. H. Beckstrand, Professor of Mechanical Engineering, Mem. Am. Soc. M. E. and member of the American Society for Testing Materials, states that a series of tests were made on macadam rock found near Salt Lake City to determine its value for road-making. Samples from twenty-seven different quarries were tested for coefficiency of wear, for toughness, for recementing, value of rock dust and weathering. Limestones, granites and several other kinds of rock were among the materials tested. The Bulletin published by the University gives the results of these tests.

NORTHWESTERN UNIVERSITY ENGINEERING BUILDING

The new Swift Hall of Engineering of the Northwestern University, Evanston, Ill., was formally dedicated, May 7, in the presence of a large number of distinguished engineers. Following the introductory remarks of Pres. Abram W. Harris, an address on The New College of Engineering, an Opportunity, was delivered by John Fillmore Hayford, Director of the College of Engineering. The Need for a Broader and More Thorough Training for Engineers was the subject of the dedicatory address, which was delivered by Charles Whiting Baker, Mem. Am. Soc. M. E.

THE ADELSKJOLD MEDAL CONFERRED ON THOMAS A. EDISON

The Adelskjold medal, awarded by tbe Kungliga Vetenskaps Akademien (Royal Academy of Sciences of Sweden) has been conferred upon Thomas A. Edison, Hon. Mem. Am. Soc. M. E., "for valuable work and discoveries in useful sciences."

Mr. Edison is the first recipient of this medal, which was established from a fund donated by the late Major Adelskjold, who, previous to his death about two years ago, was a prominent member of the "department of roads and water structures" of Sweden and was associated with important railroad enterprises.

OTHER SOCIETIES

NEW YORK ELECTRICAL SOCIETY

A meeting of the New York Electrical Society was held April 21 in New York, at which A. C. Eastwood lectured on Some Labor-Saving Uses of Electric Power in the Manufacture of Iron and Steel. The lecturer gave particular attention to the economy and increase of output attending the substitution of electricity for steam in the operation of steel mills and described numerous devices recently developed for use in refining and finishing processes.

TECHNICAL SOCIETY OF BROOKLYN

At the April 16 meeting of the Technical Society of Brooklyn, in Arion Hall, Dr. L. H. Friedburg, of the College of the City of New York, presented a paper on Photography in Colors. The speaker demonstrated the different experiments and results achieved in this field from the time of Sennebier in 1775 to Joly and Lumiere of the present time, showing beautiful reproductions of color-effects in flowers, fruits and other objects.

WIRELESS INSTITUTE

The second regular meeting of the Wireless Institute was held in the Engineering Societies Building, New York, April 7, 1909. Robert H. Marriott, President of the Institute, presented a paper in which he set forth the formation, object and history of the organization. The paper also included a list of subjects on which valuable papers could be written. Ralph W. Pope, Secretary of the American Institute of Electrical Engineers, also addressed the meeting.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION

The annual convention of the Missouri Electric Light, Gas and Street Railway Association was held April 15, 16, and 17, at the Colonial Hotel, Springfield, Mo. The address of welcome was read

by Mayor Ernst of Springfield. Several papers were presented for discussion.

Officers were elected, as follows: President, W. A. Bixby; First Vice-President, R. J. Irvine; Second Vice-President, F. E. Murray; Third Vice-President, P. A. Bertrand; Secretary and Treasurer, C. L. Clary. The constitution was amended, changing the name of the association to the Missouri Electric, Gas, Street Railway and Waterworks Association. The next meeting will be held in Jefferson City, April 14–16, 1910.

NATIONAL ASSOCIATION OF COTTON MANUFACTURERS

The annual meeting of the National Association of Cotton Manufacturers was held in Mechanics' Fair Building, Boston, Mass., April 28 and 29. Among the papers were the following: Improvements in Lighting Large Textile Areas with High Efficiency Units, A. Thatcher Holbrook; Transportation for Mill Yards, Day Baker; The Care of Commutators, T. E. Chappel.

The following officers were elected: President, Charles T. Plunkett, Mem. Am. Soc. M. E.; Vice-Presidents, G. Otis Draper, Franklin W. Hobbs; Directors for three years, George P. Grant, Jr., Edwin Farnham Greene and David S. Johnson. C. J. H. Woodbury, Mem. Am. Soc. M. E., was reëlected Secretary and Treasurer.

NEW ENGLAND RAILROAD CLUB

The regular meeting of the New England Railroad Club was held May 11 at Hotel Somerset, Boston, Mass. Charles J. Glidden gave an illustrated travelogue on The World and its People as Seen from a Motor Car, with stereopticon views. The lecture was preceded by a brief paper, with views, on The A B C of Ballooning. Mr. Glidden is an international balloon pilot, holding pilot certificates for America and France.

PROVIDENCE ASSOCIATION OF MECHANICAL ENGINEERS

On Tuesday evening, April 27, J. Ansel Brooks, Jun. Am. Soc M. E., Assistant Professor of Mechanics in Brown University, delivered the monthly lecture before the Providence Association of Mechanical Engineers on the subject of Aerial Navigation. The speaker confined most of his remarks to aeroplanes. Recent formulae giving the relation between the center of gravity and the center

of pressure were discussed. The paper was followed by a smoker and general discussion, and a business meeting.

The subject of the lecture of May 25 in Alfredian Hall, was Gauges and Indicators.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS

The fifth congress of the International Association for Testing Materials will be held in Copenhagen, September 7–11. A large number of papers will be read and discussed, and arrangements are being made for visits and excursions to places of interest.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS

On April 14 and 15 the American Society of Engineering Contractors held a meeting in the Engineering Societies Building, New York. A constitution was adopted and officers and directors elected. The object of the society is the advancement of engineering knowledge and contracting practice, the maintenance of a high professional standard among its members, and the elimination of those practices and abuses that now exist in the engineering and contracting business; and to strengethen the bond between engineers and contractors. Officers for the first year were elected as follows: President, George W. Jackson, Chicago, Ill.; First Vice-President, Halbert P. Gillette, New York; Second Vice-President, F. Baxter, New York; temporary Secretary, Daniel J. Bauer, New York. The society will begin holding monthly meetings in the fall.

INTERNATIONAL CONGRESS OF REFRIGERATING INDUSTRIES

The American Committee of the First International Congress of Refrigerating Industries held a meeting May 20, with morning and afternoon sessions, in the Engineering Societies Building, New York. The object of the meeting was to hear the final report on the work of the American Committee and also to consider the matter of organizing a permanent national committee or association to affiliate with the International Association, to assist in the work of that Association and arrange for American participation in the Vienna Congress of 1910.

In accordance with resolutions passed at the Paris Congress, a permanent International Association of Refrigeration was organized at an International Conference held in Paris, January 25 last, at which meeting the United States was represented by Consul-General Mason.

Four important International Commissions were organized under the auspices of the International Association to institute researches as to the best solution of scientific, technical and industrial questions pertaining to the field of refrigeration and to seek the best administrative measures concerning the transportation of perishable products; also to undertake experiments or tests of general or international interest. The United States is asked to coöperate in this work.

AMERICAN ELECTROCHEMICAL SOCIETY

A general meeting of the American Electrochemical Society was held at the Hotel Clifton, Niagara Falls, Canada, May 6, 7 and 8. The address of the retiring president, E. G. Acheson, was delivered on Thursday evening, the subject being The Electrochemist and the Conservation of our Natural Resources.

Several papers were presented and the following officers elected: President, L. H. Baekeland; Vice-Presidents, F. J. Tone, Carl Hering, W. D. Bancroft; Managers, E. R. Taylor, W. L. Miller, W. H. Walker; Treasurer, P. G. Salom; Secretary, J. W. Richards.

AMERICAN SOCIETY OF SWEDISH ENGINEERS

A meeting of the American Society of Swedish Engineers was held in Brooklyn, N. Y., on the evening of May 1. A paper was presented by William K. Austin upon A Rotary Compounding Engine. This was illustrated by drawings and by a small engine with 4½-in. bore.

WESTERN SOCIETY OF ENGINEERS PETITION FOR SCHOOL OF MINES AT THE STATE UNIVERSITY OF ILLINOIS

The Western Society of Engineers, through its President, Andrews Allen, has appointed the following committee to draft a memorial for presentation to the Legislature of Illinois, petitioning for the establishment of a Department of Mines at the State University: A. Bement, Mem. Am. Soc. M. E., Chairman, F. A. Delano, Bion J. Arnold, John M. Ewen, Mem. Am. Soc. M. E., Isham Randolph, and Captain R. W. Hunt, Mem. Am. Soc. M. E. The Western Society of Engineers believes that in the interests of the people of the state in general, as well as those engaged in mining business, there should be established a department of the University that will tend to develop a higher degree of skill in the conduct of the mining industry.

PERSONALS

Capt. Henry A. Allen, Mem. Am. Soc. M. E., has been appointed engineer of the Illinois division of the National Guard, and will be a member of the Governor's staff with the rank of lieutenant-colonel.

Carl Angstrom, Mem. Am. Soc. M. E., formerly Managing Director of Motala Works, Motala, Sweden, has opened an office as Consulting Engineer at Stockholm, O., Sweden.

Abram T. Baldwin, Mem. Am. Soc. M. E., has been transferred from the Syracuse, N. Y., office of the Solvay Process Co., to the Detroit, Mich., office.

F. W. Ballard, Mem. Am. Soc. M. E., presented a paper on Power Costs for Factories, at the April 13 meeting of the Cleveland Engineering Society.

Wm. O. Barnes, Mem. Am. Soc. M. E., has accepted a position as Assistant Superintendent with the Miller Lock Co., Frankford, Pa.

Clay Belsley, Mem. Am. Soc. M. E., has been appointed City Engineer of Peoria, Ill.

Prof. C. H. Benjamin, Mem. Am. Soc. M. E., is co-author with Prof. G. A. Young, Mem. Am. Soc. M. E., of a contribution upon A Series of Tests on White Steam Car, published in the May 13 issue of *The American Machinist*.

Grant D. Bradshaw, Jun. Am. Soc. M. E., has been appointed Foreman of the Billet Mill, Gary Works, of the Illinois Steel Co., Gary, Ind. He was formerly Foreman of Rod Mills, of the Joliet Plant of the company.

Prof. L. P. Breckenridge, Vice-President, Am. Soc. M. E., addressed the May 5 meeting of the Western Society of Engineers, the subject being, The Engineering Experiment Station at the State University and its Relation to Illinois Industries.

Morgan Brooks, Mem. Am. Soc. M. E., Professor of Electrical Engineering, University of Illinois, has been granted a leave of absence for foreign travel and study during the coming academic year.

John F. Buckley, Mem. Am. Soc. M. E., has become Consulting Engineer to the General Superintendent of the St. Marys Machine Co., St. Marys, Ohio. Until recently he has been associated with the Witte Iron Works Co., Kansas City, Mo., in the capacity of Superintendent.

Dudley B. Bullard, Mem. Am. Soc. M. E., delivered an address before the Society of Mechanical Foremen of Bridgeport on Modern Tools and Their Development.

An article on Heat Value of Coal from Dulong's Formula, Based on Ultimate Analysis, by N. A. Carle, Mem. Am. Soc. M. E., appeared in the May 11 issue of *Power and the Engineer*.

The Society learns with deep regret of the death of Theodore Minot Clark, fellow and member, and for four years secretary of the Boston Society of Architects.

Harold V. Coes, Jun. Am. Soc. M. E., formerly with the New York Edison Co., has accepted the position of Mechanical Engineer and Assistant to the President of the Liquid Carbonic Co., with headquarters at 67 Wells St., Chicago, Ill.

Prof. Arthur W. Cole, Jun. Am. Soc. M. E., Instructor in Mechanical Engineering, Purdue University, will go to the University of Wisconsin this summer to give a lecture course in gas and steam engines. He will also act as instructor in the laboratory. Professor Cole will return to his work at Purdue in the fall.

Charles Worthington Comstock, Mem. Am. Soc. M. E., has been appointed State Engineer of Colorado.

Barton Cruikshank, Mem. Am. Soc. M. E., formerly Designing Engineer of the Solvay Process Co., Syracuse, N. Y., has opened an office as Consulting Engineer, at Morristown, N. Y.

Carl S. Dow, Assoc. Am. Soc. M. E., has become associated with the staff of Walter B. Snow, Mem. Am. Soc. M. E. Mr. Dow was formerly Manager of Publicity, B. F. Sturtevant Co., Hyde Park, Mass.

William L. Draper, Mem. Am. Soc. M. E., formerly with the Boston, Mass., office of the General Electric Co., has retired from active work for the present.

Geo. W. Dunham, Mem. Am. Soc. M. E., formerly connected with the Olds Motor Works, Lansing, Mich., has become Chief Engineer of the Hudson Motor Car Company, Detroit, Mich.

Adolphe S. Fairbanks, Assoc. Am. Soc. M. E., has become Philadelphia Representative of the engineering department of the Vandyck-Churchill Co., with an office at 917 Arch St. Until recently, Mr. Fairbanks was associated with the Crosby Steam Gage and Valve Co., New York.

Henry A. Fergusson, Mem. Am. Soc. M. E., has severed his connection with Joseph T. Ryerson & Son, and is now District Sales Agent for the Detroit Steel Casting Co., Morava Construction Co., Steel Roof Truss Co., and H. B. Kraut Mfg. Co., with office at 514 Bank of Commerce Building, St. Louis, Mo. Mr. Fergusson is engaged also in consulting engineering work in connection with structural steel and power-plant installations.

Horatio A. Foster, Mem. Am. Soc. M. E., has been transferred from the valuation department of the Public Service Commission, District No. 1, New York, to Detroit, to take charge of the appraisal of the properties of the Detroit United Railways, for Bion J. Arnold, with whom he has been associated in the valuation of the properties of the New York City railways.

Ernest E. Gamon, Jun. Am. Soc. M. E., until recently Factory Manager of the Neptune Meter Co., Long Island City, N. Y., has opened an office in Newark, N. J., for the manufacture of water meters.

Prof. Geo. F. Gebhardt, Mem. Am. Soc. M. E., is the author of Some Live-Steam Separator Tests, published in the May 11 number of *Power and the Engineer*.

John J. Harman, Jun. Am. Soc. M. E., has become a member of the Harman Engineering Co., civil and mechanical engineers, Peoria, Ill.

A paper on The Present Value of Electrical Structural Steel, by Henry D. Hibbard, Mem. Am. Soc. M. E., presented at the May 6-8 meeting of the American Electrochemical Society at Niagara Falls.

Frank E. Herdman, Mem. Am. Soc. M. E., formerly in the service of the Enid Electric and Gas Co., Enid, Okla., as Secretary and Treasurer, has accepted a position as Manager and Engineer of the Water and Light Properties of the Village of Winnetka, Ill.

Rudolph Hering, Mem. Am. Soc. M. E., has been appointed Consulting Engineer for sewers and garbage disposal plant of San Francisco.

James H. Herron, Mem. Am. Soc. M. E., has entered the employ of the Motch & Merryweather Machinery Co., Pittsburg, Pa., in the capacity of Manager. He was formerly associated with the Detroit Steel Products Co., Detroit, Mich., as Engineer.

A biographical sketch of William Hewitt, Mem. Am. Soc. M. E., was published in the May number of *Cassier's Magazine*.

Charles A. Howard, Jun. Am. Soc. M. E., has accepted a position with the E. W. Bliss Co., Brooklyn, N. Y. Until recently he was Assistant to the Mechanical Engineer of the New York Edison Co., New York.

Joseph H. Hyde, Mem. Am. Soc. M. E., Chief Engineer of the American Car and Foundry Co., has been transferred from the St. Louis, Mo., office to Chicago, Ill.

Herman G. Jakobsson, Mem. Am. Soc. M. E., formerly with the Midvale Steel Co., Philadelphia, Pa., has been appointed Ordnance Designer of the War Department.

Frank N. Jewett, Mem. Am. Soc. M. E., who was District Manager of the Wagner Electric Mfg. Co., of St. Louis, Mo., in charge of the Chicago office, has been made Sales Manager of that company at the home office, St. Louis, Mo.

Geo. C. King, Mem. Am. Soc. M. E., has been appointed Assistant General Manager and Mechanical Engineer of the Union Irrigation Co., Washington, La. He was formerly superintendent of the Russell Engine Co., Massillon, Ohio.

Joseph P. Kirkup, Jun. Am. Soc. M. E., until recently connected with the Green Fuel Economizer Co., as Testing and Experimental Engineer, has become representative of the S. J. Wing Mfg. Co., with an office in the Philadelphia Bourse.

Francis W. Lane, Assoc. Am. Soc. M. E., for fifteen years Editor of *The Railway Age,* prior to its consolidation with *The Railroad Gazette,* has moved to Chicago, where he will act as engineering correspondent of *The London Times.*

Henry I. Lea, Assoc. Am. Soc. M. E., presented a paper on A New Method of Gas Manufacture at the March 17 meeting of the Illinois Gas Association.

Frank J. McDevitt, Jun. Am. Soc. M. E., has become Vice-President and Manager of the Ohio Steam Specialty Co., Youngstown, O. Until recently he was connectd with the Ohio Works of the Carnegie Steel Co., Youngstown, Ohio.

Emerson McMillin, Mem. Am. Soc. M. E., President of the American Light & Traction Co., New York, has been elected to the newly created position of Chairman of the Board.

Frank W. Magin, Jun. Am. Soc. M. E., recently with the Allis-Chalmers Co., Milwaukee, Wis., is now located at the New York office of the company.

Guido H. Marx, Mem. Am. Soc. M. E., Associate Professor of Machine Design in Stanford University, has been promoted to the rank of professor, the appointment to take effect next fall.

Geo. B. Massey, 2d, Jun. Am. Soc. M. E., is the author of Development of Dredges for Placer Deposits, which appeared in the April 24 number of *The Engineering and Mining Journal.*

Guy L. Meaker, Jun. Am. Soc. M. E., until recently President of The Meaker Co., Chicago, Ill., has become associated with the American Steel and Wire Co., as Assistant Superintendent of the Rockdale Works, Joliet, Ill.

Gustav A. Merkt, Assoc. Am. Soc. M. E., is the author of Analysis of Power Consumption in a Roll Pass, which was published in the April 22 issue of *The Iron Trade Review.*

Walter R. Metz, Jun. Am. Soc. M. E., has been made Superintendent of Buildings, Government Printing Office, Washington, D. C. He was formerly Leading Draftsman of the U. S. Navy Yard.

Henry C. Meyer, Jr., Mem. Am. Soc. M. E., is the author of A Central Heating and Lighting Plant for the United States Military Academy, which was published in the April 29 number of *The Electrical World.*

Dr. Richard Moldenke, Mem. Am. Soc. M. E., gave a general talk on Recent Progress in Foundry Metallurgy at the May 3 meeting of the Pittsburg Foundrymen's Association.

Herbert H. Morrison, Mem. Am. Soc. M. E., formerly of New York, has opened an office in the Syndicate Trust Building, St. Louis, Mo., as Consulting Engineer for mechanical and electrical work.

Alfred Noble, Mem. Am. Soc. M. E., and Silas H. Woodard have opened an office as civil and consulting engineers at 7 East 42d St., New York. Mr. Noble was formerly Chief Engineer, East River Div., P. T. & T. R. R., New York.

Walter A. Pearson, Mem. Am. Soc. M. E., sailed for Rio de Janeiro, May 28, to assume the position of Assistant General Manager of the Rio de Janeiro Tramway, Light and Power Co., Rio de Janeiro, Brazil. For the past few months Mr. Pearson was in the New York office of the Company.

Dwight T. Randall, Mem. Am. Soc. M. E., late engineer in charge of fuel tests, Technologic Branch, United States Geological Survey, has associated himself with the Arthur D. Little Laboratory of Engineering Chemistry of Boston, in charge of the Department of Fuel Engineering.

Train Resistance is the subject of an article contributed to the May 7 issue of *The Railroad Age Gazette*, by A. Stucki. Mem. Am. Soc. M. E.

Cecil Hamelin Taylor, Assoc. Am. Soc. M. E., who has been in the engineering department of the E. R. Thomas Motor Co., Buffalo, N. Y., has accepted a similar position with the Chalmers-Detroit Co.

Frank H. Taylor, Mem. Am. Soc. M. E., sailed May 19 for England as special representative of the Mergenthaler Linotype Co.

David Townsend, Mem. Am. Soc. M. E., read a paper before the mechanical section of the Franklin Institute, Philadelphia, Pa., on the evening of April 29, on Prevention of Smoke.

Samuel D. Warriner, Mem. Am. Soc. M. E., General Manager of the Lehigh Valley Coal Co., has been made Vice-President of that company. Mr. Warriner is now Vice-President and General Manager.

Samuel Whinery, Mem. Am. Soc. M. E., has been appointed by Governor Fort one of three commissioners to appraise and revalue the railroad and canal property in the State of New Jersey.

Henry S. Wood, Mem. Am. Soc. M. E., resigned May 1 as Eastern Agent of the North American Dredging Co., New York, and will open an office as a consulting engineer in the Park Row Building, New York. He will give special attention to dredges, dredging and reclamation of land.

E. P. Worden, Mem. Am. Soc. M. E., delivered a lecture on Modern Mine Pumping before the Engineers' Society, Milwaukee, Wis., April 14.

Machine Shop Equipment

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CLASSIFIED LIST OF ADVERTISERS PAGES 24 TO 27

EXTRACTS FROM THE BOOK OF THE

COPIES OF THE BOOK

Multi-stop and Double Turners

FIG. 1 illustrates the advantage of the *double stop* for each position of the turret, and the *double* adjustment of each turner. This piece has six finished diameters and six shoulders, and is turned by only three turners, which occupy only three positions on the turret. This not only leaves the remaining positions free for other tools, but it saves the operator the time and energy required to run the turret slide back each time.

All this is obtained without complication, and without introducing any features that are annoying when not in use.

In addition to the double stop for each of the six positions of the turret, we have an extra stop, consisting of a pin which may be dropped into any one of the six holes at the rear of the turret slide. This makes it possible to borrow five extra stops for any one of the tools, and gives to this tool seven length or shoulder stops, and leaves one stop for each of the remaining tools.

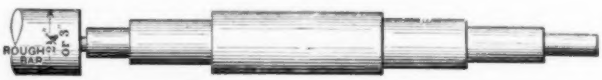

FIG. 1

The illustrations, Figs. 2 and 3, give examples of what one tool can do in this machine on chuck work, when we take advantage of the seven length stops and the seven shoulder stops of the cross-feed head.

Of course, in general practice three or four stops for one tool are all that will be needed, but since the modern cutting steels have greater durability, there is nothing lost by giving each tool all the work it can do.

Outer face and all shoulders and diameters accurately finished to independent stops by one tool. When roughing and finishing cuts are required, the roughing tool can be set near enough to use the same stops that are accurately set for the finishing tool. When an extra tool is used to give a roughing cut it is set as indicated by dotted lines in Figs. 2 and 3.

We find it difficult to illustrate all of the classes of work that can be turned out by this machine, but a little thought will suggest

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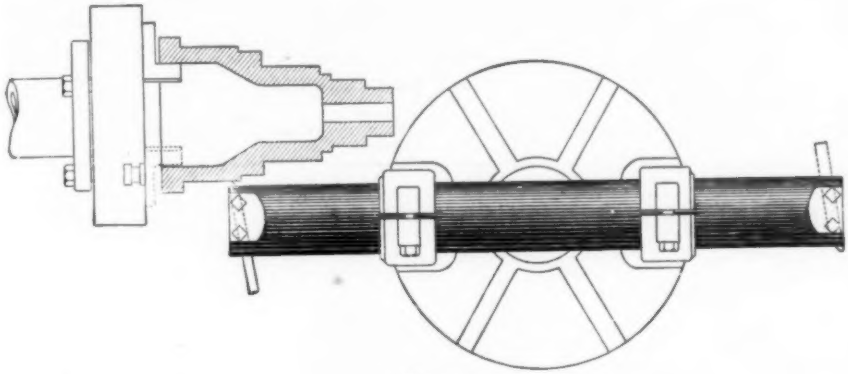

FIG. 2

many forms that may be readily handled in bar and chucking work, both steel and iron, on account of the many provisions for bringing both turret and cross slide up to fixed stops; either by power feed or by hand.

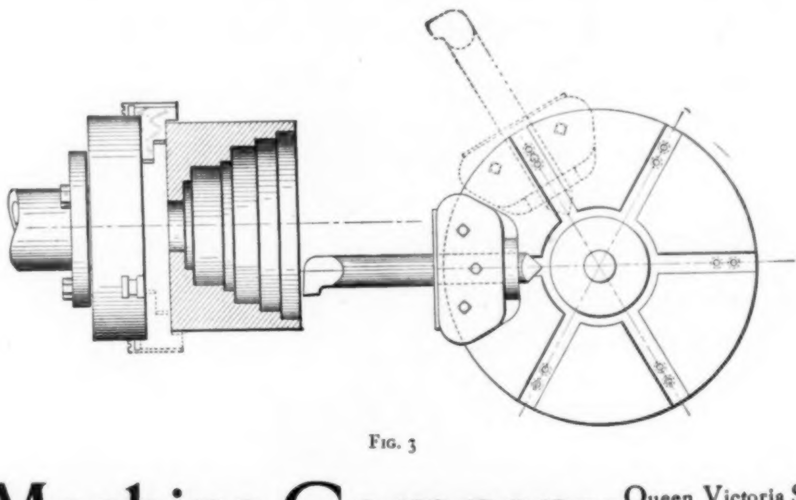

FIG. 3

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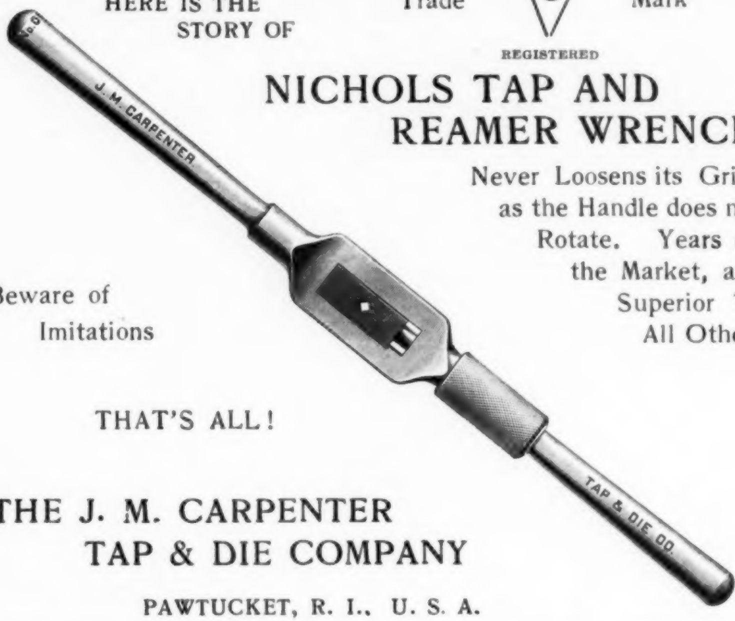

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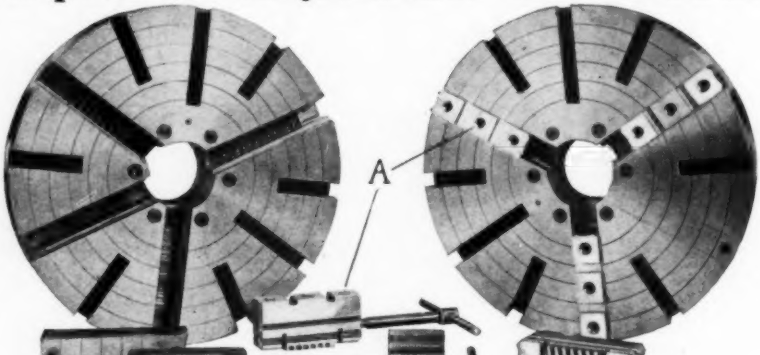

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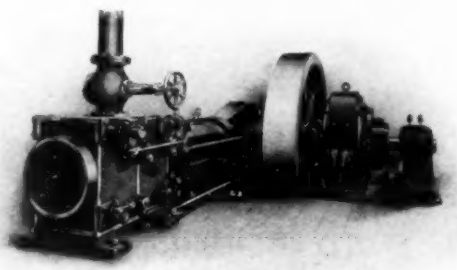

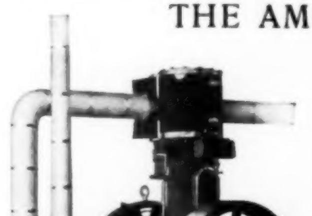

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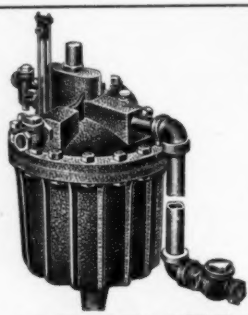

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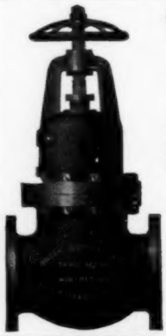

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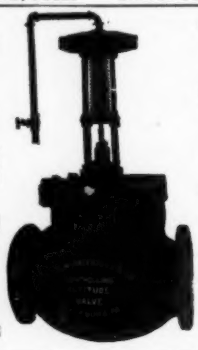

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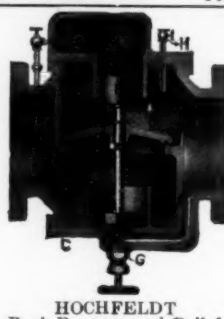

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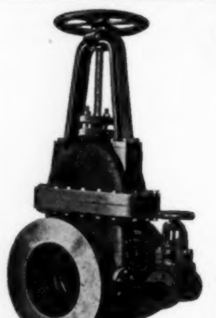

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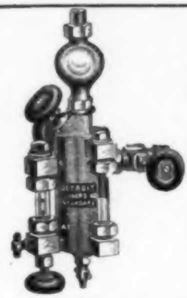

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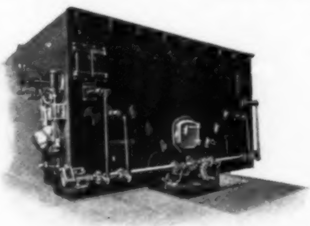

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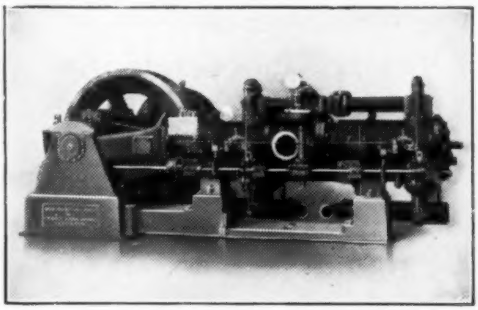

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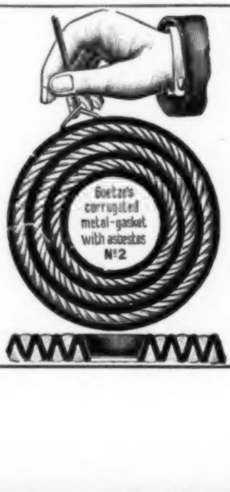

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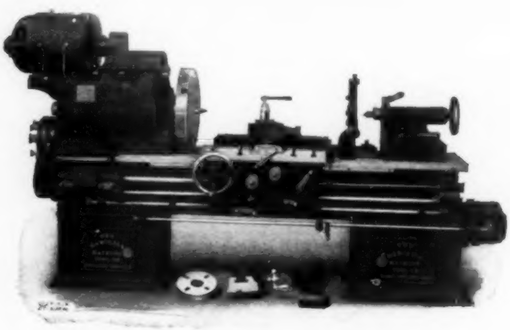

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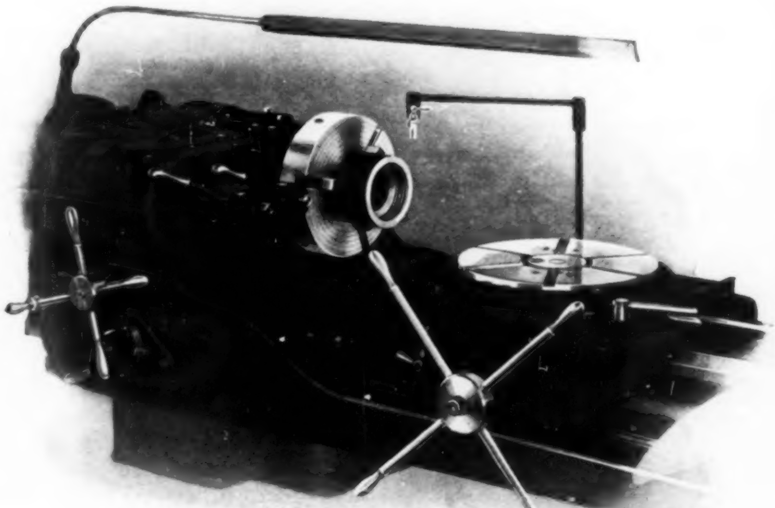

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Chemical Society. London. *Journal.* Vol. 1–26.

Deutsche Chemische Gesellschaft. Berichte. Vol. 1–6. 1868–1874.

Foundry. Vol. 1–22. 1892–1902.

The Gas Engine. Cincinnati. Vol. 3–4. 1901–1902.

Le Génie Civil. Paris. Vol. 1–23. Vol. 32.

Institution of Naval Architects. London. Transactions. Vol. 15, 1874.

Industries and Iron. London. Vol. 16–17. 1894.

Machinery. New York. Vol. 1, 1894.

Journal of Physical Chemistry. Vol. 1–5, 1897–1901.

Mining and Scientific Press. Vol. 1–9, 11–19 (1860–1869): 24–33. 1872–1876.

Neues Jahrbuch fur Mineralogie, Geognosie, Geologie und Petrefaktenkunde. 1836–38.

New Zealand Mines Record, Wellington, N. Z. Vol. 1–6, 1896–1902.

Physikalische Zeitschrift. Vol. 1–2. 1899–1900.

Power, New York. Vol. 1–6. 1879–1885.

Practical Engineer. London. Vol. 5–6. 1888–1889.

Progressive Age. Vol. 1–14.

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Sibley Journal of Engineering, Sibley College, Cornell University. Vol. 12, 1897–1898.

Zeitschrift für Angewandte Chemie. Vol. 1–4, 1887–91.

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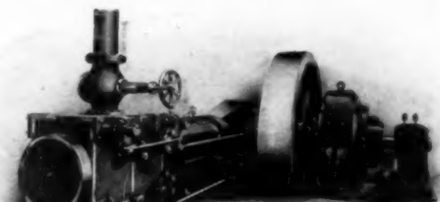

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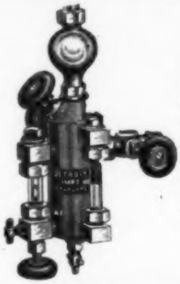

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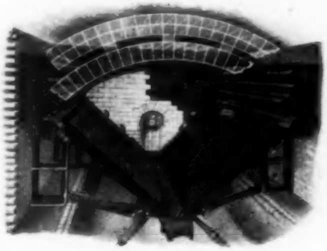

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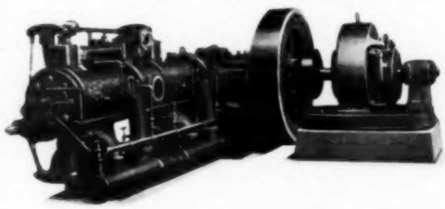

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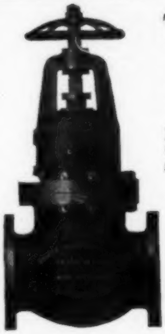

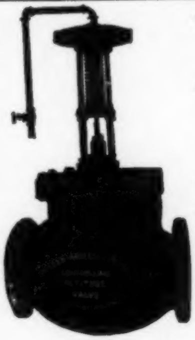

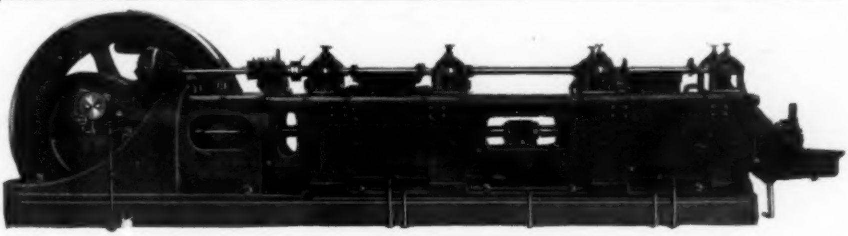

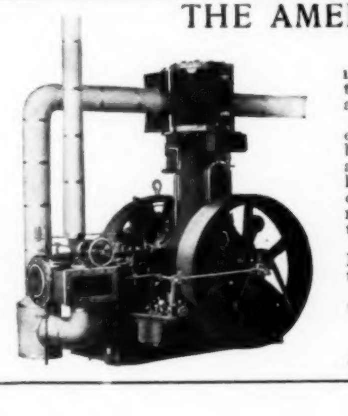

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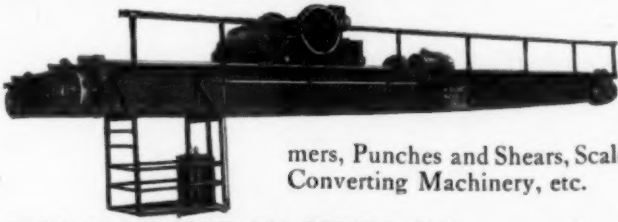

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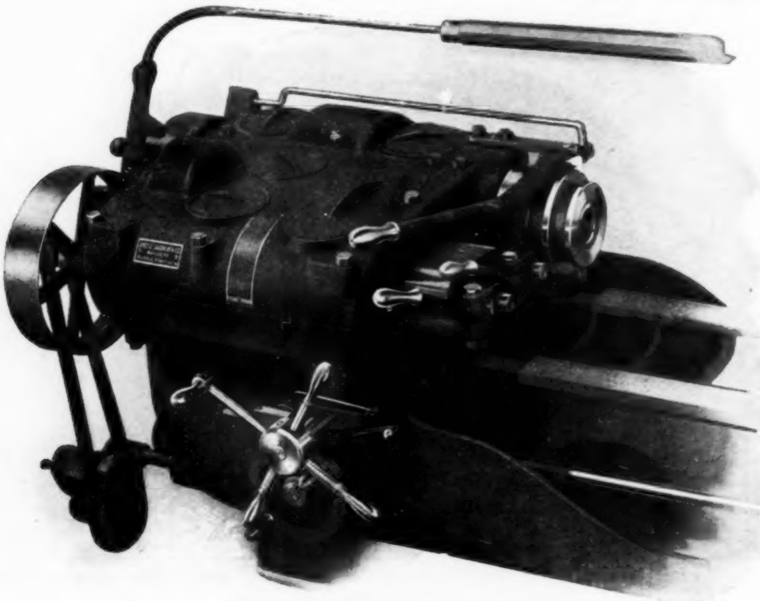

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THE distinctive feature of the original Flat Turret Lathe was the flat, plate-shaped tool holder from which the lathe took its name. The original work-holding headstock possessed many distinctive features, such as the automatic chuck and roller feed, but it contained the now nearly obsolete cone pulley drive and back gear scheme. In the present machine we have combined an ideal scheme of speed regulation with many other desirable features.

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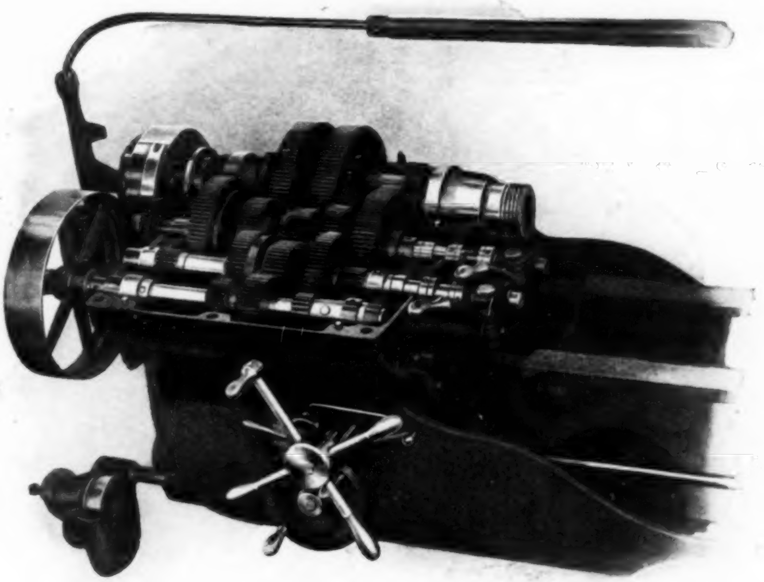

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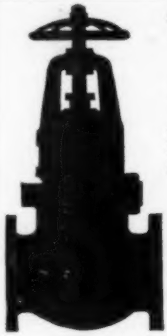

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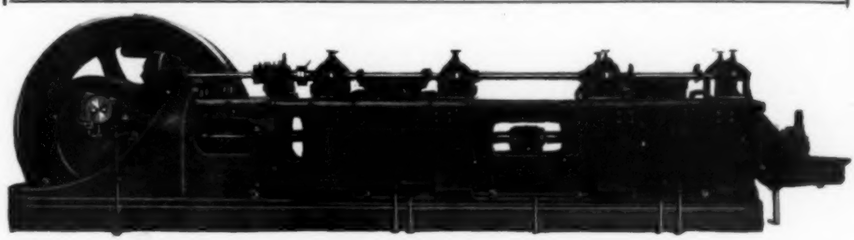

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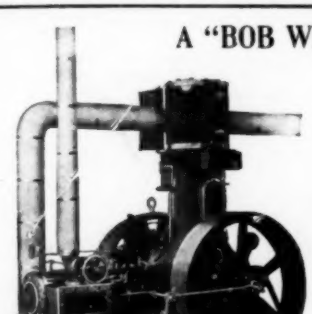

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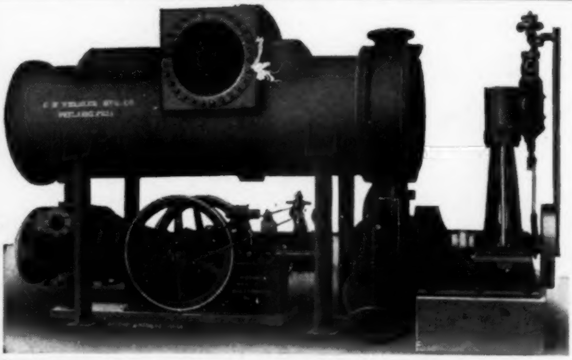

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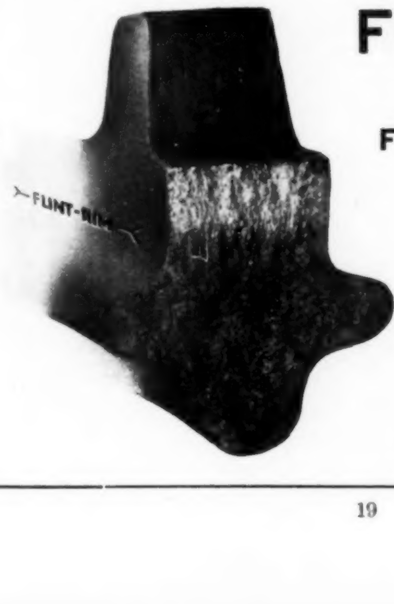

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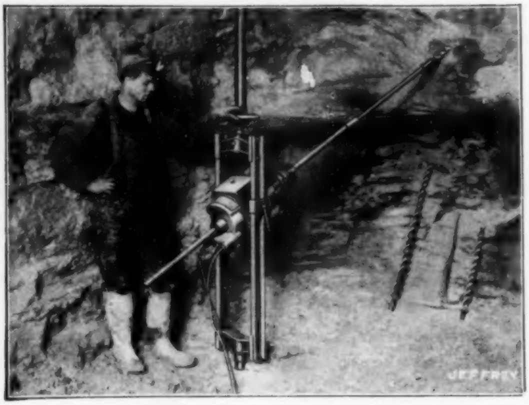

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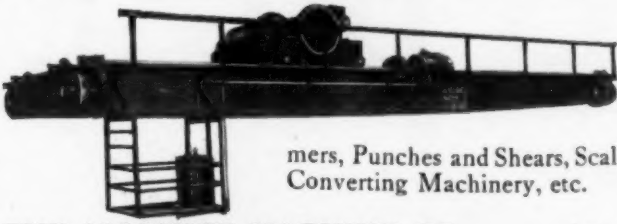

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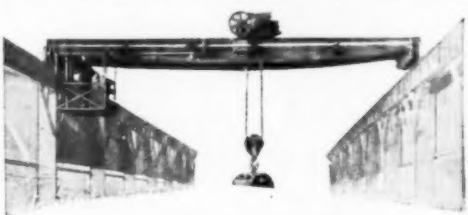

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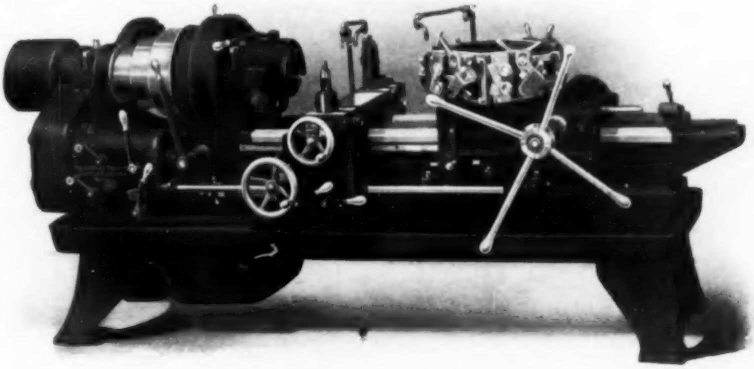

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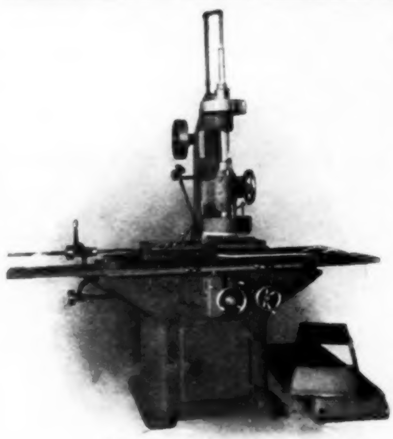

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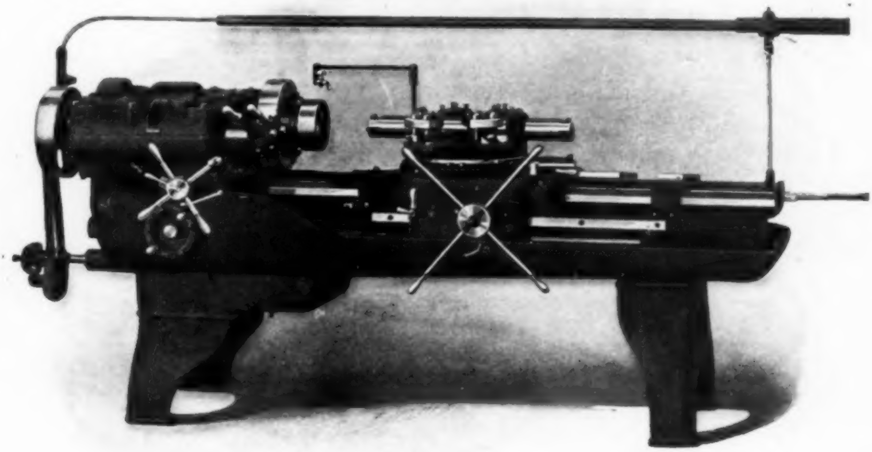

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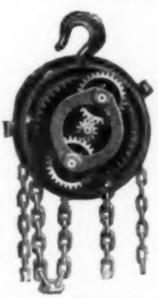

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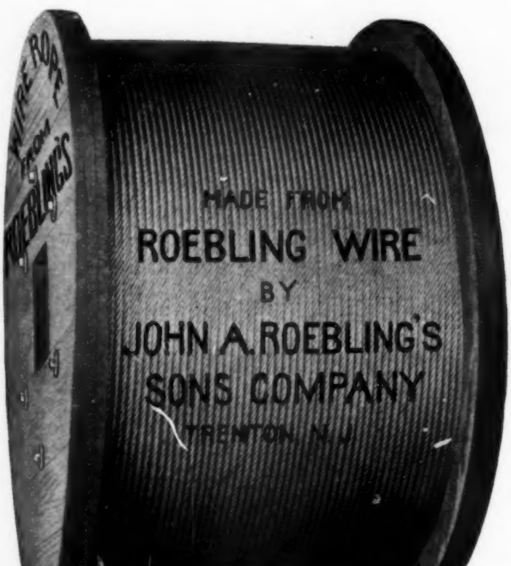

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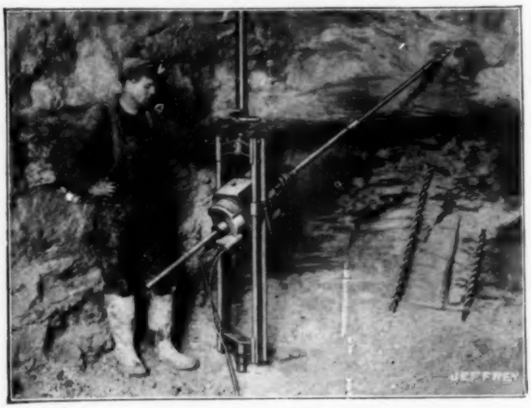

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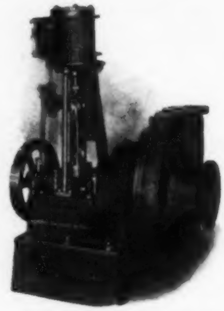

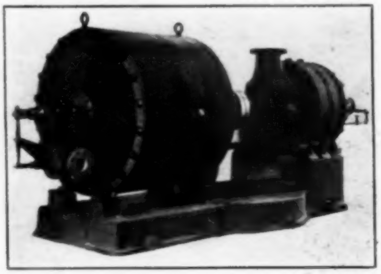

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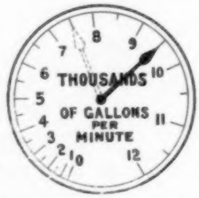

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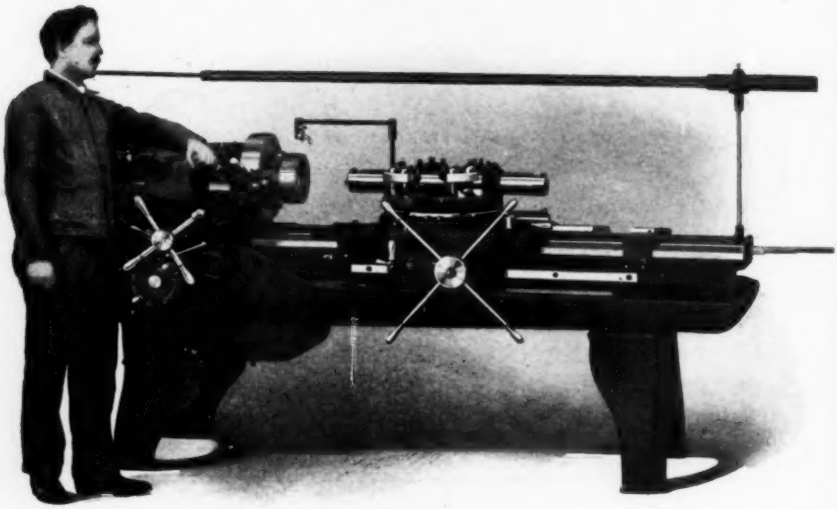

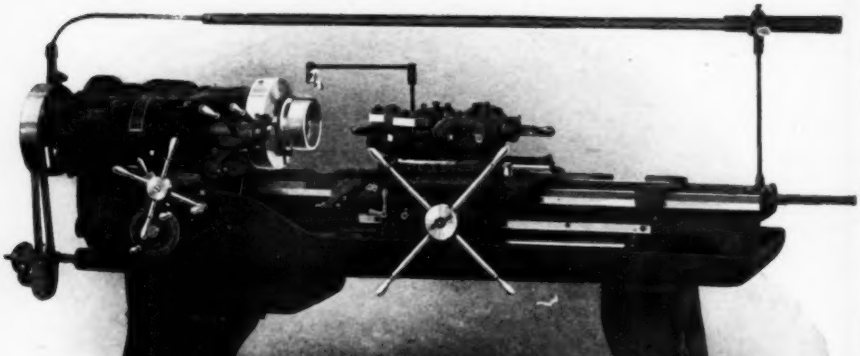

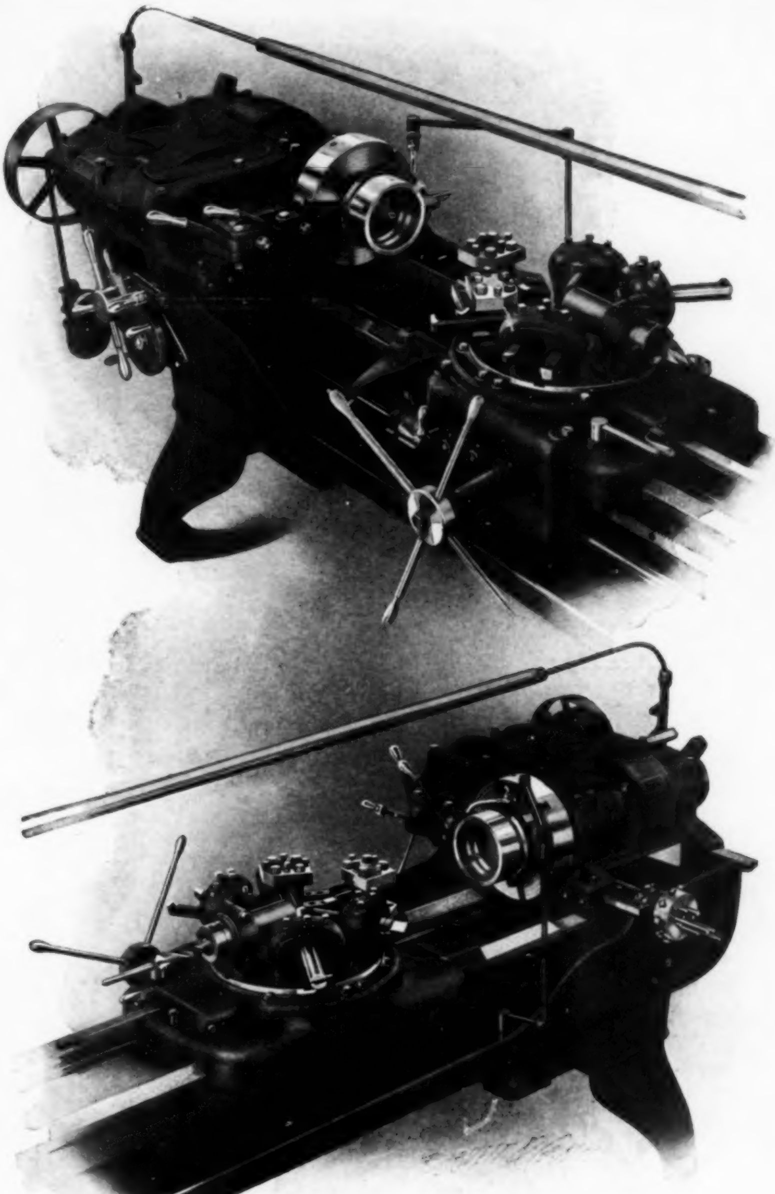

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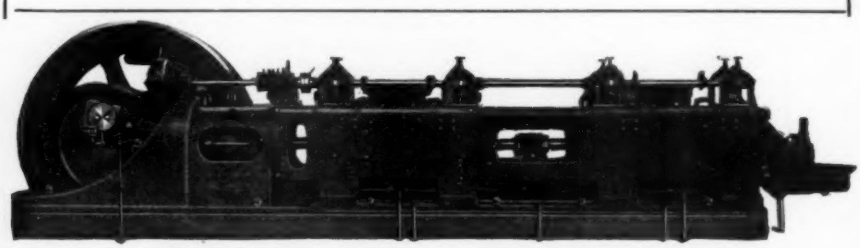

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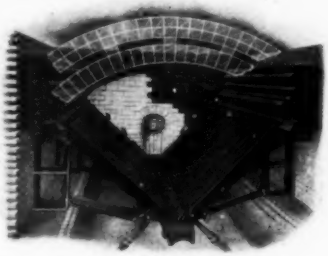

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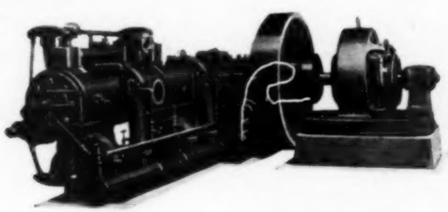

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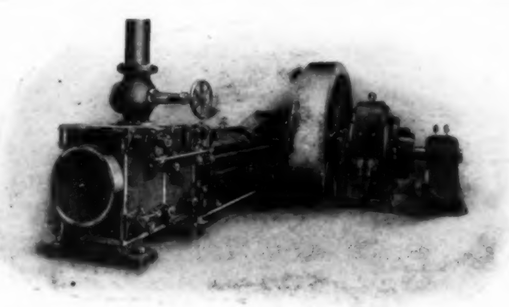

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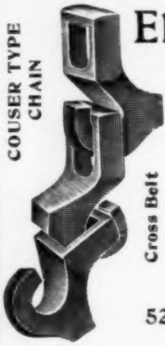

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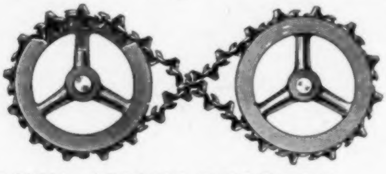

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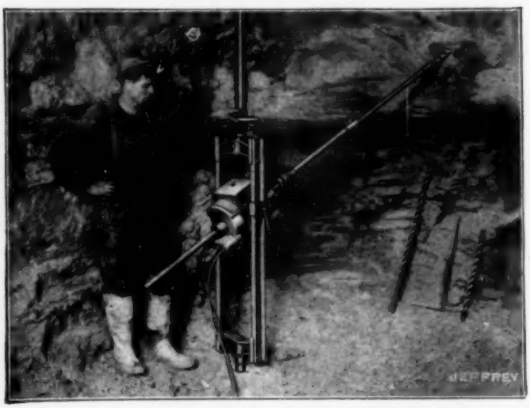

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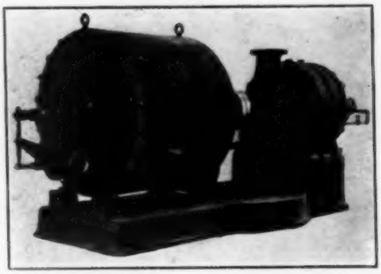

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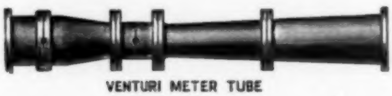
ACCURATE  DURABLE

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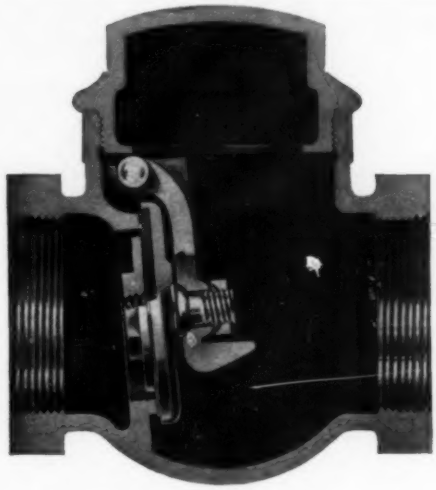

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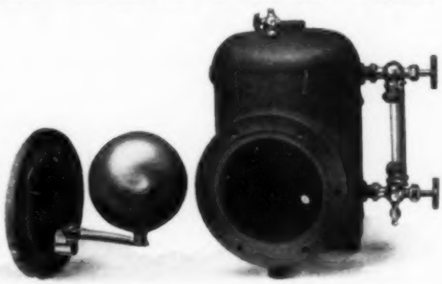

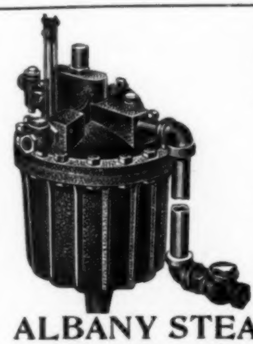

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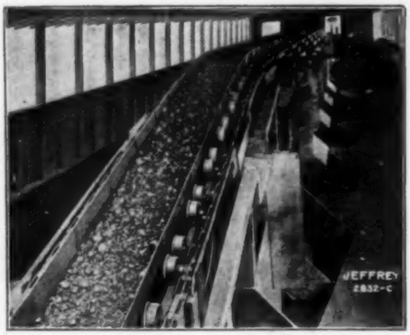

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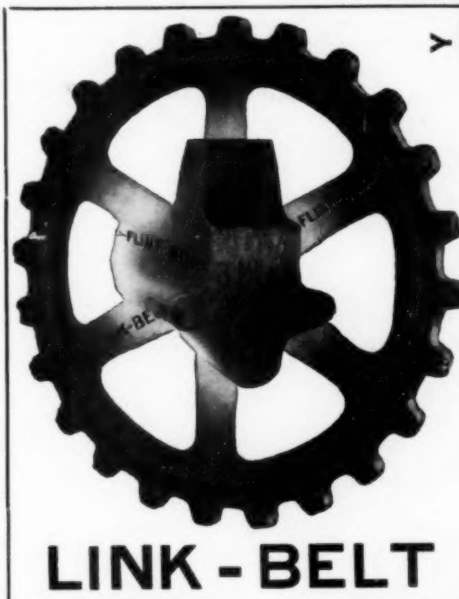

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COLD STORAGE, LONDON. Vol. 1-8. 1898-1905.

CEMENT AGE, NEW YORK. Vol. 1-3. To Jan. 1907.

COLD STORAGE AND ICE ASSOCIATION. *Proceedings*. Vol. 1-5. 1900-1904. Vol. 8. 1907.

COLD STORAGE AND ICE TRADE JOURNAL. Vol. 1-6. To 1903. Vol. 12. July-Dec., 1904.

CONSTRUCTION MODERNE. Paris. To 1893. 1897—date.

DIE DEUTSCHE ZUCKER INDUSTRIE. Vol. 1-33. To Jan., 1908.

FEILDEN'S MAGAZINE. Vol. 1. 1899. (Title changed to Engineering Review.)

FIRE AND WATER. To 1886.

GAS ENGINE, CINCINNATI. Vol. 1-2. 1899-1900.

GAS ENGINEERS' MAGAZINE. Vol. 1-17. 1885-1901.

DIE GAS MOTORENTECHNIK. Vol. 1-5, 6. No. 1-9. To Jan., 1908.

LE GENIE CIVIL. Vol. 1-23. 1880-1892.

GLASERS ANNALEN FUR GEWERBE UND BAUWESEN. Vol. 1-7. 1865-1889.

GUMMIE ZEITUNG. Vol. 1-22. To Jan. 19, 1909.

HEATING AND VENTILATING ENGINEERING REVIEW. Vol. 1-4. 1891-1894.

HEATING AND VENTILATING MAGAZINE. Vol. 1-2. 1904-1905.

HORSELESS AGE. Vol. 3. 1895.

ILLUSTRIETE AËRONAUTISCHE MITTEILUNGEN. Vol. 1-12. No. 17. To Sept. 9, 1908.

INDUSTRIES. Vol. 15-17. July, 1893-Dec., 1894.

INSTITUTE OF MARINE ENGINEERS. To Vol. 20. Aug., 1908.

INSTITUTE CIVIL ENGINEERS OF IRELAND. Vol. 1-12, 18, 20, 21. To 1882, 1888, 1890, 1893.

INSTITUTE OF ENGINEERS AND SHIPBUILDERS OF SCOTLAND. Vol. 1-27. 1857-1883.

INTERNATIONAL RAILROAD CONGRESS. Brussels.

Proceedings of 1st Congress, Brussels, 1885.
Proceedings of 2d Congress, Milan, 1887.
Proceedings of 3d Congress, Paris, 1889.
Proceedings of 4th Congress, St. Petersburg, 1892.
Proceedings of 6th Congress, 1900—date.

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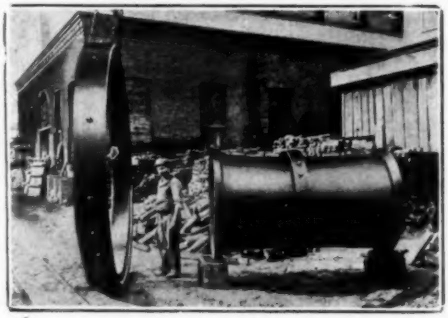

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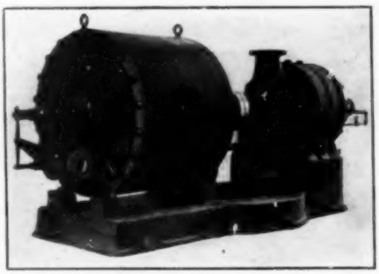

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